55-2840-241-23

TECHNICAL MANUAL

AVIATION UNIT
AND AVIATION INTERMEDIATE
MAINTENANCE MANUAL

ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N6887191
NSN 2840-01-013-1339

This copy is a reprint which includes current pages from Changes 1 through 10.

HEADQUARTERS, DEPARTMENT OF THE ARMY

NOV 77

D101.11:

READEX FICHE best copy available

CHANGE
NO. 10

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 17 November 1986

Aviation Unit and Aviation Intermediate Maintenance Manual

ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 6887191
NSN 2840-01-013-1339

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
i and ii	i and ii
2-3 and 2-4	2-3 and 2-4
3-5 and 3-6	3-5 and 3-6
3-11 and 3-12	3-11 and 3-12
4-3 through 4-6	4-3 through 4-6
4-11 through 4-14	4-11 through 4-14
4-14A/4-14B	4-14.1 and 4-14.2
4-15 and 4-16	4-15 and 4-16
4-16A/4-16B	4-16.1/4-16.2
5-3 and 5-4	5-3 and 5-4
5-9 and 5-10	5-9 and 5-10
---	5-10.1 through 5-10.3/5-10.4
5-11 and 5-12	5-11 and 5-12
5-13 through 5-16	5-13 through 5-16
5-19 and 5-20	5-19 and 5-20
5-25 through 5-28	5-25 through 5-28
7-1 and 7-2	7-1 and 7-2
7-7 and 7-8	7-7 and 7-8
7-17 and 7-18	7-17 and 7-18
9-1 and 9-2	9-1 and 9-2
10-1 and 10-2	10-1 and 10-2
10-7 and 10-8	10-7 and 10-8
12-1 through 12-4	12-1 through 12-4
13-1 and 13-2	13-1 and 13-2
B-13 and B-14	B-13 and B-14
Index 5 and Index 6	Index 5 and Index 6

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Organizational, Direct Support and General Support Maintenance requirements for Engine, Gas Turbine, T-63-A-720 (TM 55-2840-241-series).

CHANGE }
No. 9 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 30 March 1984

Aviation Unit and Aviation Intermediate Maintenance Manual

ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 6887191
NSN 2840-01-013-1339

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below.

	Remove pages	Insert pages
Chapter 3	3-5 and 3-6	3-5 and 3-6
	3-11 and 3-12	3-11 and 3-12
Chapter 4	4-5 and 4-6	4-5 thru 4-6A/4-6B
	4-9 and 4-10	4-9 and 4-10
	4-13 thru 4-14A/4-14B	4-13 thru 4-14A/4-14B
	4-16A/4-16B	4-16A/4-16B
Chapter 5	5-3 and 5-4	5-3 and 5-3
	5-9 and 5-10	5-9 and 5-10
	5-25 and 5-26	5-25 and 5-26
Chapter 7	7-1 and 7-2	7-1 and 7-2
	7-7 and 7-8	7-7 and 7-8
Appendix B	B-3 and B-4	B-3 and B-4
	B-13 thru B-16	B-13 thru B-16

2. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

3. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Organizational Maintenance requirements for OH-58 and OH-58C aircraft.

URGENT

TM 55-2840-241-23
C 8

CHANGE
NO. 8

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 8 November 1982

Aviation Unit and Aviation Intermediate Maintenance Manual

ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 6887191
NSN 2840-01-013-1339

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below.

	Remove Pages	Insert Pages
Chapter 4	4-13 thru 4-16	4-13 thru 4-16
Chapter 12	12-1 and 12-2	12-1 and 12-2
Chapter 13	13-1/13-2	13-1/13-2

2. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

3. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Organizational Maintenance Requirements for OH-58 and OH-58C aircraft.

URGENT

URGENT

TM 55-2840-241-23
C 7

CHANGE }
NO. 7 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 2 August 1982

Aviation Unit and Aviation Intermediate
Maintenance Manual

ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 6887191
NSN 2840-01-013-1339

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below.

	Remove Pages	Insert Pages
Chapter 4	4-13 and 4-14	4-13 and 4-14 4-16A/(4-16B blank)

2. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

3. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Organizational Maintenance Requirements for OH-58 and OH-58C aircraft.

CHANGE }
No. 6 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 13 May 1982

Aviation Unit and Aviation Intermediate Maintenance Manual
ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 6887191
NSN 2840-01-013-1339

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below.

	Remove pages	Insert pages
Chapter 1	1-1 and 1-2	1-1 and 1-2
	1-13 and 1-14	1-13 and 1-14
Chapter 2	2-5 and 2-6	2-5 and 2-6
Chapter 3	3-5 and 3-6	3-5 and 3-6
	3-11 and 3-12	3-11 and 3-12
Chapter 4	4-13 thru 4-16	4-13 thru 4-16
Chapter 5	5-11 and 5-12	5-11 and 5-12
	5-16A/B	5-16A/B
	5-21 and 5-22	5-21 and 5-22
	5-25 thru 5-28	5-25 thru 5-28
Chapter 7	7-1 and 7-2	7-1 and 7-2
Chapter 10	10-1 thru 10-4	10-1 thru 10-4
Chapter 13	13-1/13-2	13-1/13-2

2. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

3. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Organizational Maintenance Requirements for OH-58 and OH-58C Aircraft.

CHANGE
No. 5

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 26 June 1981

Aviation Unit and Aviation Intermediate Maintenance Manual
ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 6887191

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below.

	Remove pages	Insert pages
Chapter 2	2-5 and 2-6	2-5 and 2-6
Chapter 4	4-5 thru 4-8	4-5 thru 4-8
	4-11 thru 4-15/4-16	4-11 thru 4-16
Chapter 5	5-3 and 5-4	5-3 thru 5-4A/B
	5-9 and 5-10	5-9 and 5-10
	5-15 and 5-16	5-15 thru 5-16A/B
		5-18A/B
Chapter 7	7-1 thru 7-4	7-1 thru 7-4
Appendix B	B-1 and B-2	B-1 and B-2

2. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

3. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Major General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Organizational Maintenance Requirements for OH-58 and OH-58C Aircraft.

CHANGE
No. 4

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 14 January 1981

Aviation Unit and Aviation Intermediate Maintenance Manual
ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 6887191
NSN 2840-01-013-1339

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below.

	Remove pages	Insert pages
Chapter 3	3-1 and 3-2	3-1 and 3-2
	3-5 and 3-6	3-5 and 3-6
Chapter 4	4-1 and 4-2	4-1 and 4-2
	4-13 thru 4-15/4-16	4-13 thru 4-15/4-16
Chapter 5	5-3 and 5-4	5-3 and 5-4
	5-9 thru 5-12A/5-12B	5-9 thru 5-12A/5-12B
Chapter 7	7-1 and 7-2	7-1 and 7-2
Chapter 10	10-1 thru 10-4	10-1 thru 10-4
	10-7 and 10-8	10-7 and 10-8

2. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

3. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Major General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Organizational Maintenance Requirements for OH-58 and OH-58C aircraft.

WARNING

DANGEROUS CHEMICALS

are used in this equipment. Skin rash may result from contact with lubricating fluids. Provide adequate ventilation when using solvents, fuels, or lubricating oil in a closed area.

WARNING

HIGH VOLTAGE

may be present in the igniter lead. Ensure that the ignition system has been off for at least five minutes before disconnecting the lead. Ground the lead to the engine using an insulated screwdriver to dissipate any energy stored in the exciter.

WARNING

SEVERE BURNS

may result from contact with the engine hot section. Ensure that the engine has had sufficient time to cool before attempting to perform maintenance on the hot section.

WARNING

EXPLOSIVE VAPORS

Prior to removing engine from container, make sure both sections of container are grounded and the container is opened in a well ventilated area.

WARNING

PRESSURIZED CONTAINER

Make sure that all air pressure has been released before loosening nuts and bolts on shipping container. If nuts are removed before pressure is released, internal pressure could blow off cover.

WARNING

An operating procedure, practice, etc., which if not correctly followed, could result in personal injury or loss of life.

CAUTION

An operating procedure, practice, etc., which if not strictly observed, could result in damage to or destruction of equipment.

NOTE

An operating procedure, condition, etc., which it is essential to highlight.

TECHNICAL MANUAL **NO. 55-2840-241-23**	***HEADQUARTERS*** ***DEPARTMENT OF THE ARMY*** ***WASHINGTON, D.C.* 2 November 1977**

Aviation Unit and Aviation Intermediate Maintenance Manual

ENGINE, AIRCRAFT, GAS TURBINE, T63-A-720
NSN 2840-01-013-1339

			Paragraph	Page
CHAPTER	1.	INTRODUCTION		1-1
Section	I.	General	1-1	1-1
	II.	Description	1-5	1-2
CHAPTER	2.	SPECIAL TOOLS, TEST EQUIPMENT, AND CONSUMABLE MATERIALS		2-1
Section	I.	Special Tools and Test Equipment	2-1	2-1
	II.	Consumable Materials	2-2	2-4
CHAPTER	3.	PREPARATION FOR SERVICE, STORAGE, AND ENGINE HANDLING		3-1
Section	I.	Preparation for Service and Storage	3-1	3-1
	*II.	Engine Handling	3-18	3-13
CHAPTER	4.	TROUBLESHOOTING		4-1
CHAPTER	5.	ACCESSORIES SERVICING		5-1
Section	I.	General	5-1	5-1
	II.	Fuel System	5-6	5-3
	III.	Lubrication System	5-18	5-16
	IV.	Anti-icing and Bleed Air Systems	5-31	5-22
	V.	Ignition System	5-34	5-25
	VI.	Miscellaneous Accessories	5-38	5-28
CHAPTER	6.	ENGINE DISASSEMBLY		6-1
CHAPTER	7.	CLEANING, INSPECTION, AND REPAIR		7-1
Section	I.	Cleaning	7-1	7-1
	II.	Inspection	7-8	7-4
	III.	Repair	7-23	7-15
CHAPTER	8.	ASSEMBLY OF SUBASSEMBLIES		8-1
CHAPTER	9.	FINAL ENGINE ASSEMBLY		9-1
CHAPTER	10.	FINAL ENGINE TEST		10-1
CHAPTER	11.	TORQUES AND DIMENSIONAL LIMITS		11-1
Section	I.	Torque Values	11-1	11-1
	II.	Dimensional Limits	11-2	11-4
CHAPTER	12.	SPECIAL INSPECTIONS		12-1
Section	I.	Engine Hot End	12-1	12-1
	II.	Compressor	12-3	12-3
	III.	Abnormal Flight Maneuver Inspection	12-9	12-4
CHAPTER	13.	OVERHAUL INTERVAL AND RETIREMENT SCHEDULE		13-1
APPENDIX	A.	REFERENCES		A-1
	B.	MAINTENANCE ALLOCATION CHART		B-1
INDEX				Index 1

LIST OF ILLUSTRATIONS

Number Title Page

1-1. Right Side View of Engine (Typical) 1-2
1-2. Engine Airflow 1-3
1-3. Fuel System Schematic 1-5
1-4. Fuel Control System Schematic 1-7
1-5. Fuel Pump and Filter Assembly 1-9
1-6. Engine Lubrication System Schematic 1-11
1-7. Oil Pump Schematic 1-12
1-8. Compressor Bleed Control Valve 1-13
1-9. Compressor Bleed Control Valve Operation 1-13
2-1. Engine Turning Adapter 6799790 2-2
2-2. Compressor Vibration Pickup Mounting Bracket 6872539 2-2
2-3. Loop Clamps 6799952 and 6799953 2-2
2-4. Compressor Protector Kit 6886204 2-2
2-5. Engine Assembly Lift 6796963 2-2
2-6. Mechanical Puller Kit 6796941 2-2
2-7. Modular Engine Test Stand LTCT10465-02 2-3
2-8. Engine Assembly Turnover Stand 6795579 2-3
2-9. Ground Idle Wrench 6798292 2-3
3-1. Engine Shipping Container 3-3
3-2. Engine Shipping Parts 3-4
3-3. Engine Shipping Container Stenciling and Labeling 3-9
3-4. Accessories Shipping Container 3-11
3-5. Accessories Shipping Container Stenciling 3-11
3-6. Gas Producer Fuel Control Ports Identification 3-12
3-7. Engine Assembly Turnover Stand 6795579 3-13
3-8. Combustion Section Removal 3-15
4-1. OH58C HIT TOT Work Sheet 4-14
4-2. OH58C HIT TOT Log 4-15
5-1. Universal Fittings 5-2
5-2. Fuel, Oil and Air Tubing 5-5
5-3. Fuel System Components 5-6
5-4. Fuel Filter Replacement 5-8
5-5. Fuel Control Quadrant and Pointer 5-9
5-6. Gas Producer Fuel Control Adjustments 5-10
5-6.1 Start/Acceleration and Start Derichment Adjustments 5-10.1
5-7. Fuel Control Max Flow Stop Adjustment 5-11
5-8. Fuel Control Fuel Filter 5-12
5-9. Carbon Buildup on Fuel Nozzle 5-14
5-10. Particle Accumulation on Magnetic Chip Detector 5-17
5-11. Oil Filter, Housing, Check Valve, and Regulator Valve 5-19
5-12. External Oil Check Valve 5-21
5-13. Engine Air Systems (Anti-icing and Bleed Air) 5-23
5-14. Anti-icing Valve Poppet Seat Replacement 5-24
5-15. Anti-icing Valve Lever Repair 5-25
5-16. Ignition System 5-26
5-17. Spark Igniter 5-27
6-1. Compressor Case Assembly 6-2
7-1. Bleed Valve Jet and Nozzle Removal 7-3
7-2. Compressor Blade Damage Caused By Rub 7-5
7-3. Compressor Vane Erosion 7-6
7-4. Gearbox Accessory Pad Locations 7-7
7-5. Outer Combustion Case Inspection 7-8
7-6. Dent Limits—Top of Outer Combustion Case 7-9
7-7. Outer Combustion Case Air Tube Boss 7-9
7-8. Combustion Liner Inspection 7-13
7-9. Inspection of Combustion Liner Dome Louvers 7-14
7-10. Compressor Rotor Blade Leading and Trailing Edge Blend Limits 7-15
7-11. Compressor Rotor Blade Tip Blend Limits 7-15
7-12. Compressor Blade Surface Blending Limits 7-16
7-13. Compressor Stator Vane Blend Limits 7-17
7-14. Seal Puller Kit 7-18
7-15. Gearbox External Seals 7-19
7-16. Gearbox External Stud Data 7-20
10-1. Idle and Flight Autoratation GPTOT Limits 10-3
10-2. Diffuser Vent Orifice Installation 10-7
12-1. Typical First-stage Turbine Nozzle 12-2

LIST OF TABLES

Number Title Page

1-1. Leading Particulars 1-14
1-2. Performance Ratings (Standard Sea Level Static Conditions) 1-14
2-1. Special Tools and Test Equipment 2-1
2-2. Consumable Materials 2-4
3-1. Container Air Pressure vs Ambient Temperature 3-8
4-1. Troubleshooting 4-1
5-1. Adjustments to Improve Starting 5-10.2
5-2. Anti-icing Air Valve Inspection and Repair 5-24
7-1. Combustion Liner Inspection 7-10
10-1. Operating Limits 10-4
10-2. Test Requirements 10-6
10-3. Functional Test Schedule 10-8
11-1. Torque Values 11-1
11-2. Dimensional Limits 11-4
12-1. Overtemperature During Start 12-1
12-2. Overtemperature During Power Transients 12-1
12-3. First-stage Turbine Nozzle and Shield Inspection 12-2
13-1. Overhaul and Retirement Interval 13-1
Maintenance Allocation Chart B-3

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope.

a. This manual is issued expressly for Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) activities. Its purpose is to familiarize maintenance personnel having limited technical training and experience with the maintenance functions to be performed on the Army Model T63-A-720 (Detroit Diesel Allison Model 250-C20C) turboshaft engine. The study and use of this manual will enable maintenance personnel to perform the assigned functions with maximum efficiency. This manual provides all essential information to accomplish the three levels of maintenance on the complete engine, its components, and systems as prescribed in the Maintenance Allocation Chart (MAC). (Refer to Appendix B.)

CAUTION

Use only chrome plated steel or unplated steel tools for the disassembly or reassembly procedures described in this manual. The use of cadmium on zinc plated tools is not permitted since these platings are prone to chipping and flaking. Should these chips enter the engine, they may contaminate the lubrication system, ultimately clogging the filters or produce intergranular attack on nickel or titanium base alloys at elevated temperatures.

1-2. Maintenance Forms and Records.

Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

1-3. Reporting of Errors.

Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports shall be submitted on DA Form 2028 (Recommended Changes to Publication and Blank Forms) and forwarded directly to Commander, US Army Troop Support and Aviation Materiel Readiness Command ATTN: DRSTS-MPSD, 4300 Goodfellow Blvd., St. Louis, MO 63120.

1-4. Destruction of Army Material to Prevent Enemy Use.

Procedures for destruction of Army materials to prevent enemy use are prescribed by TM 750-244-1-5.

Section II. DESCRIPTION

1-5. General

a. The T63-A-720 Series engine consists of a multistage, axial-centrifugal compressor, a single combustion chamber a two-stage gas producer turbine, a free-two-stage power turbine, and a power and accessory gearbox. (See figure 1-1.)

b. The major engine systems are fuel and control, lubrication, ignition, anti-icing air, temperature measurement, and compressor acceleration bleed air.

c. Engine description includes a discussion of each major component and each major system.

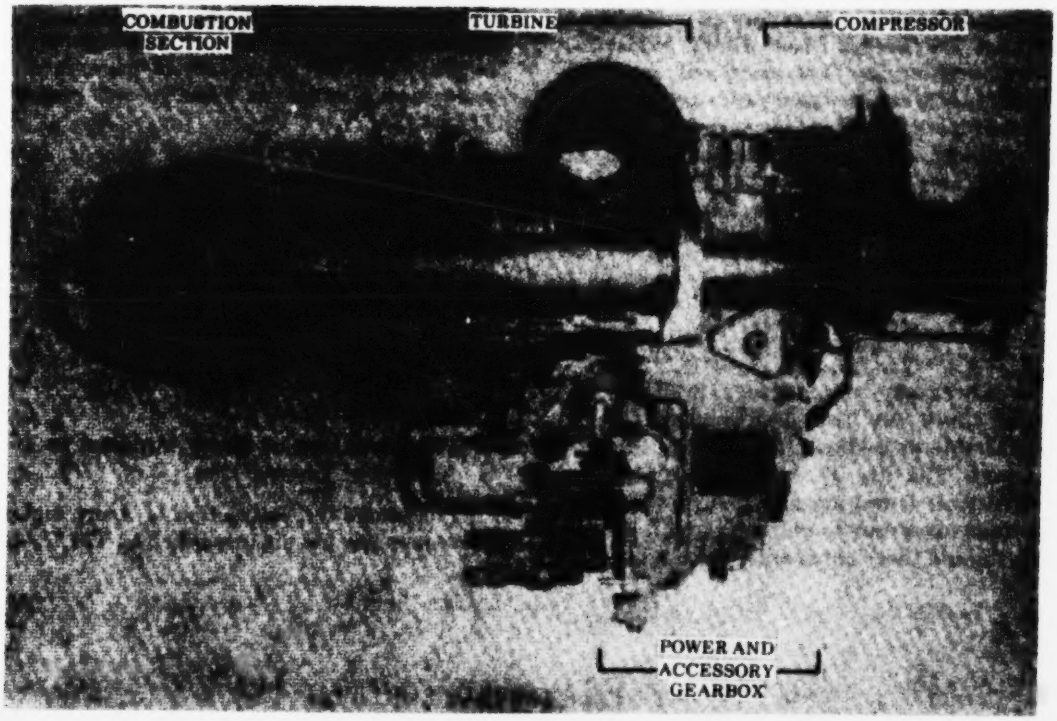

COMBUSTION SECTION
TURBINE
COMPRESSOR
POWER AND ACCESSORY GEARBOX
323878

Figure 1-1. Right Side View of Engine (Typical)

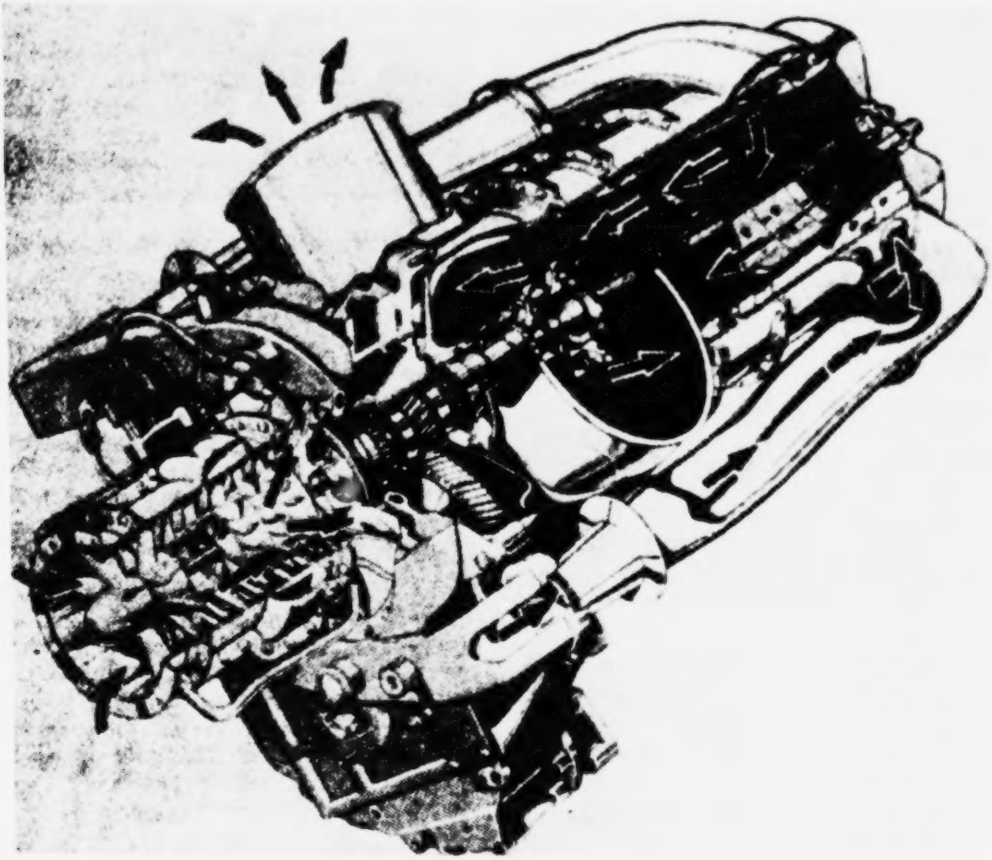


Figure 1-2. Engine Airflow

1-6. Compressor.

a. The compressor assembly consists of a compressor front support, case assembly with stator vanes, rotor assembly with blades, centrifugal impeller, front diffuser assembly, rear diffuser assembly, and diffuser scroll. Air enters the compressor through the front support. (See figure 1-2.) Struts in the support guide the air and direct it in the proper direction into the first stage of the compressor rotor. The air is then compressed by six axial compressor stages and one centrifugal stage. As the air passes through the axial stages, it is alternately accelerated by the rotor blades and decelerated by the stator vanes. At the same time, it is compressed into an ever decreasing space. This results in an increase of both air pressure and temperature.

b. The sixth-stage compressor vanes direct the compressed air into the impeller. The impeller vanes centrifugally accelerate the air through an ever decreasing space to further increase the air pressure and temperature. It is then discharged across the diffuser vanes and directed into the diffuser scroll.

c. The diffuser scroll collects the compressor discharge flow at a constant velocity and directs it rearward through two ports (one on each side of the engine) to the combustion section. Each of the ports has turning vanes which direct the air rearward.

1-7. Combustion Section.

a. The combustion section consists of two compressor discharge air tubes (one on each side of the engine), a combustion outer case, and a combustion liner. A spark igniter and a fuel nozzle are installed in the rear of the outer combustion case.

b. Compressor discharge air is ducted from the diffuser scroll to the combustion outer case by the two compressor discharge air tubes. Air enters the single combustion liner at the rear through holes in the liner. The air is mixed with fuel sprayed from the fuel nozzle. The fuel-air mixture is then ignited in the combustion liner to provide combustion. Combustion gases move forward out of the combustion liner to the turbine.

1-8. Turbine.

a. The turbine consists of a gas producer turbine support, a power turbine support, a turbine and exhaust collector support, a two-stage gas producer turbine, and a two-stage power turbine. The turbine is mounted between the combustion section and the power and accessory gearbox. The two-stage gas producer turbine drives the compressor and accessory gear train. The two-stage power turbine furnishes the output power of the engine.

b. Combustion gases from the combustion section are expanded across the two stages of the gas producer turbine. Energy is extracted from the gas stream and converted to shaft torque to drive the compressor and gas producer gear train.

c. The combustion gases then move forward from the gas producer turbine and are expanded across the two stages of the power turbine. Additional energy is extracted from the gas stream and converted to shaft torque. This shaft torque is then transmitted through the power turbine gear train to the output shaft.

d. The expanded gas from the power turbine passes through the exhaust collector support and is exhausted upward through the twin ducts. The small amount of energy remaining in the gas stream assists in scavenging the exhaust gases from the engine.

1-9. Power and Accessory Gearbox.

The main power and accessory drive gear trains are enclosed in a single gear case. The gear case serves as the structural support of the engine. All engine components, including the engine-mounted accessories, are attached to the case. At 100% engine speed, reduction gearing reduces power turbine speed from 33,290 to 6,016 rpm at the output drive pads. The power turbine gear train has a torquemeter to measure engine output torque. Accessories driven by the power turbine gear train are the power turbine tachometer-generator (N2) and the power turbine governor. The gas producer gear train drives the oil pump, fuel pump, gas producer fuel control, and tachometer-generator (N1). The gearbox has a spare accessory mounting pad which is driven by the gas producer gear train. During starting the starter-generator cranks the engine through the gas producer gear train. After completion of the starting cycle, the starter-generator functions as a generator.

1-10. Description of Engine Operation

a. The engine is a free turbine engine; that is, there is no mechanical connection between the gas producer turbine and the power turbine. The power turbine is gas coupled to the gas producer turbine by the combustion gases.

b. The helicopter uses a conventional control system. The collective pitch of the helicopter rotor establishes the power output demand on the engine. For all practical purposes, helicopter rotor speed is held constant by the engine and its control system.

c. The fuel control is connected to the twist grip on the pilot's and copilot's collective pitch sticks. The power turbine governor is interconnected to the collective pitch sticks through a coordinated system of bellcranks and linkages. Any change in collective pitch resets the governor to a new power demand. This demand is transmitted to the gas producer fuel control, which resets and varies the N1 speed of the gas producer turbine accordingly.

d. A motor-actuated speed trimming device is installed in the linkage between the collective pitch sticks and the power turbine governor lever. It is operated by a trim switch on pilots collective pitch stick, and allows engine output speed to be varied over a normal range of approximately 98 to 103% (5896 to 6196) rpm).

1-11. Fuel and Control System.

a. The gas producer fuel control is located schematically in the fuel system between the fuel pump assembly and the fuel nozzle. (see figure 1-3.) A power turbine governor, also a part of the control system, provides control intelligence to the gas producer fuel control.

b. The system controls engine power output by controlling gas producer speed. Gas producer speed levels are established by the action of the power turbine governor which senses power turbine speed. Power turbine speed is selected by the operator. The power required to maintain this speed is automatically maintained by power turbine governor action on the gas producer fuel control.

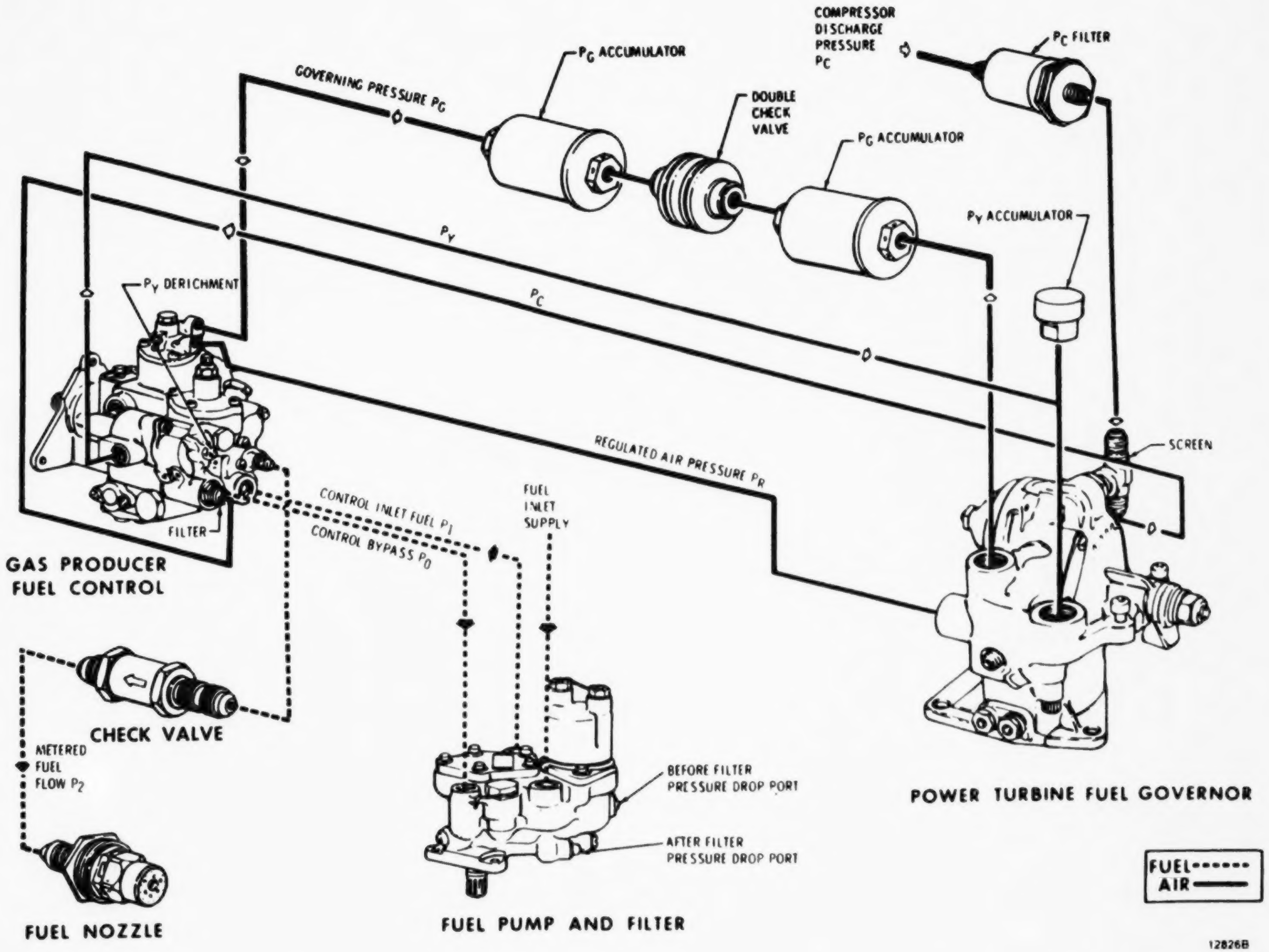

COMPRESSOR DISCHARGE PRESSURE P_C
P_C FILTER
P_G ACCUMULATOR
GOVERNING PRESSURE P_G
DOUBLE CHECK VALVE
P_G ACCUMULATOR
P_Y ACCUMULATOR
P_Y DERICHMENT
P_Y
P_C
SCREEN
REGULATED AIR PRESSURE P_R
FILTER
GAS PRODUCER FUEL CONTROL
CONTROL INLET FUEL P_1
CONTROL BYPASS P_0
FUEL INLET SUPPLY
CHECK VALVE
METERED FUEL FLOW P_2
FUEL NOZZLE
BEFORE FILTER PRESSURE DROP PORT
AFTER FILTER PRESSURE DROP PORT
FUEL PUMP AND FILTER
POWER TURBINE FUEL GOVERNOR
FUEL ------
AIR ——
12826B

Figure 1-3. Fuel System Schematic

c. The power turbine governor lever schedules the governor requirements. The power turbine governor, in turn, schedules the gas producer speed to a changed power output to maintain output shaft speed.

d. Fuel flow for engine control depends on compressor discharge pressure (Pc), engine speed (gas producer—N1 and/or power turbine—N2), and lever angle. Fuel flow is a function of Pc as sensed in the fuel control. Variations of fuel flow schedules are obtained by modulating the Pc to Px and Py pressures in the control through the action of a bleed-down circuit actuated by the governors. (See figure 1-4.)

1-12. Gas Producer Fuel Control.

a. The gas producer fuel control has a bypass valve, metering valve, acceleration bellows, governing and enrichment bellows, manually operated cutoff valve, maximum pressure relief valve, torque tube seal and lever assembly, and a start derichment valve. The maximum pressure relief valve protects the system from excessive fuel pressure.

b. Fuel enters the control from the engine fuel pump and filter assembly and is delivered to the metering valve. The bypass valve maintains a constant pressure differential across the metering valve. Also, excess fuel is bypassed to the fuel pump and filter assembly through an external line connecting the pump bypass inlet to the bypass outlet port of the gas producer fuel control.

c. The metering valve is operated by lever action through movement of the governor and acceleration bellows. Metering valve area depends on valve travel. Before light-off and acceleration, the metering valve is set at a pre-determined open position by the acceleration bellows under the influence of ambient pressure (Pc at zero rpm).

d. The start derichment valve is open during light-off and acceleration to a set Pc. The open derichment valve vents Py pressure to atmosphere. Venting Py allows the governor bellows to move the metering valve against the minimum flow stop. At minimum flow the metering valve provides the required lean fuel schedule after light-off. As compressor rpm increases, the derichment valve is closed by Pc acting on the derichment bellows. When the derichment valve is closed, control of the metering valve is returned to the normal operating schedule.

e. During acceleration, the Px and Py pressures are equal to the modified compressor discharge pressure (Pc) up to the point where the speed enrichment orifice is opened by flyweight action. Opening the speed enrichment orifice bleeds Px pressure whil Py remains at a value equal to Pc. Under the influenc of the Py minus Px pressure drop across the governo bellows, the metering valve moves toward the maximum flow stop where it increases fuel flow.

f. Gas producer speed is controlled by the ga producer fuel control governor. A set of flyweight operate the governor lever which controls the governo bellows (Py) bleed at the governing orifice. Flyweight operation of the governor lever is opposed by a variable spring load. The spring force is established by the throttle lever acting on a spring scheduling cam. Opening the governing orifice bleeds Py pressure and allows Px pressure to control the governor bellows. The Px influence on the bellows moves the metering valve toward minimum flow and at a position where metered flow is at steady state requirements.

g. The governor reset assembly in the gas producer fuel control limits or governs power turbine speed. Control of the reset assembly is derived from the power turbine governor. The power turbine governor also provides quick responding overspeed protection by bleeding governor servo (Py) pressure from the gas producer fuel control.

1-13. Power Turbine Governor.

a. Power turbine speed is scheduled by the power turbine governor lever and the power turbine speed scheduling cam. The cam sets a governor spring load which opposes a flyweight output. As the desired speed is approached, the flyweights operating against the governor spring move a link to open the power turbine governor orifice. The flyweights also open the overspeed bleed (Py) orifice but at a higher speed than the regular governor (Pg) orifice.

b. The governor orifice is downstream of a bleed supplied by a regulated air pressure (Pr). Opening the orifice results in a reduced pressure downstream of the bleed (Pg) as an inverse function of increasing speed. Regulated pressure (Pr) and governing pressure (Pg) are applied to opposite sides of a diaphragm in the governor reset section of the gas producer fuel control. The force generated by Pr minus Pg across the diaphragm acts on the gas producer power output link through the governor reset rod. This force supplements the weight force in the gas producer fuel governor to reset (reduce) the gas producer speed. Gas producer speed cannot exceed the gas producer fuel governor setting. The Pr minus Pg diaphragm is preloaded for establishing the active Pr minus Pg range. Pr pressure is supplied from engine Pc pressure by an air regulator valve.

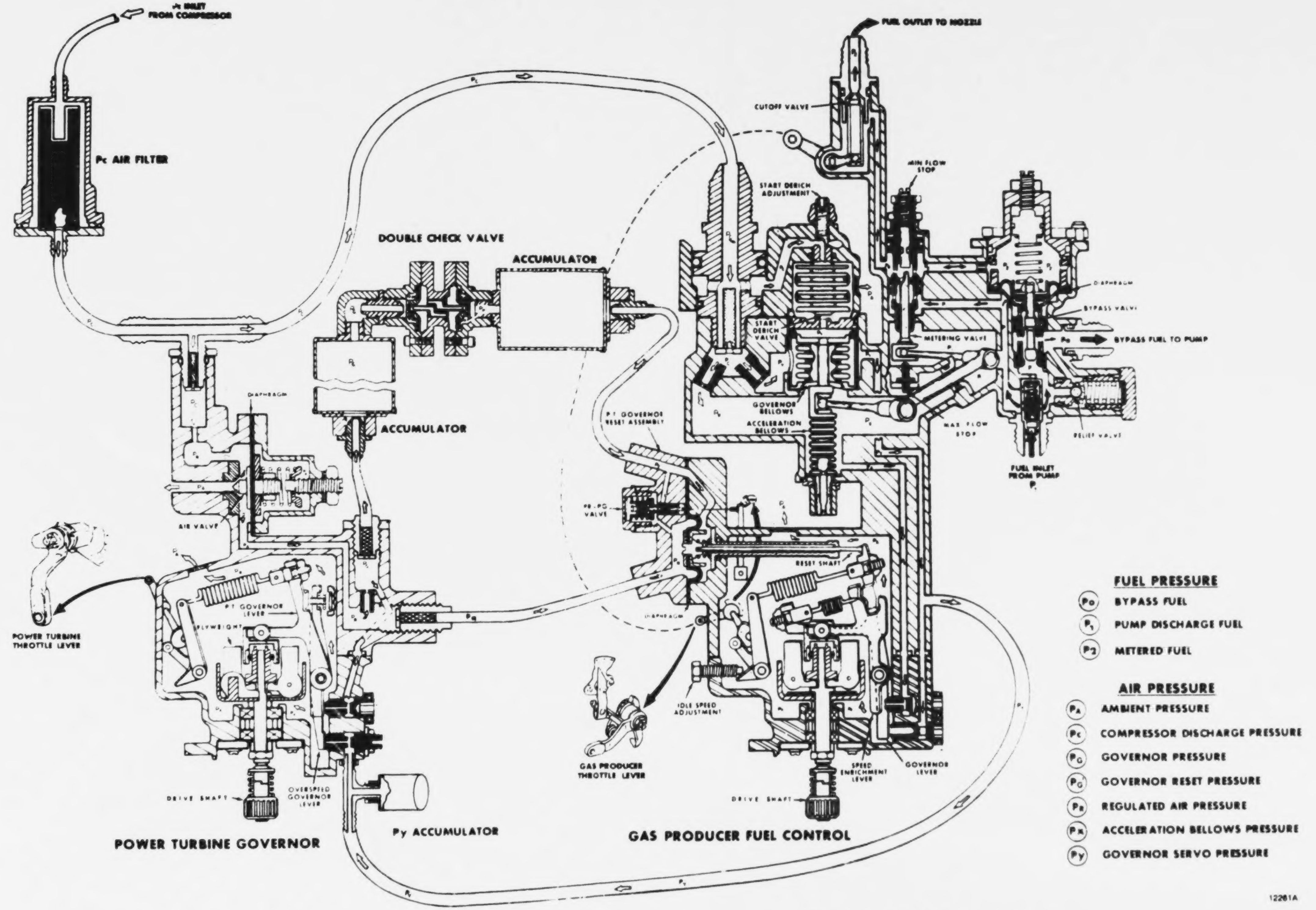

Pc INLET FROM COMPRESSOR
Pc AIR FILTER
DOUBLE CHECK VALVE
ACCUMULATOR
ACCUMULATOR
DIAPHRAGM
AIR VALVE
POWER TURBINE THROTTLE LEVER
P.T. GOVERNOR LEVER
FLYWEIGHT
DRIVE SHAFT
OVERSPEED GOVERNOR LEVER
POWER TURBINE GOVERNOR
Py ACCUMULATOR
FUEL OUTLET TO NOZZLE
CUTOFF VALVE
START DERICH ADJUSTMENT
START DERICH VALVE
MIN FLOW STOP
DIAPHRAGM
BYPASS VALVE
METERING VALVE
BYPASS FUEL TO PUMP
GOVERNOR BELLOWS
ACCELERATION BELLOWS
MAX FLOW STOP
RELIEF VALVE
FUEL INLET FROM PUMP
P.T. GOVERNOR RESET ASSEMBLY
PR-PG VALVE
RESET SHAFT
DIAPHRAGM
IDLE SPEED ADJUSTMENT
GAS PRODUCER THROTTLE LEVER
SPEED ENRICHMENT LEVER
GOVERNOR LEVER
DRIVE SHAFT
GAS PRODUCER FUEL CONTROL
FUEL PRESSURE
Po BYPASS FUEL
P1 PUMP DISCHARGE FUEL
P2 METERED FUEL
AIR PRESSURE
PA AMBIENT PRESSURE
Pc COMPRESSOR DISCHARGE PRESSURE
PG GOVERNOR PRESSURE
PG' GOVERNOR RESET PRESSURE
PR REGULATED AIR PRESSURE
Px ACCELERATION BELLOWS PRESSURE
Py GOVERNOR SERVO PRESSURE
12261A

Figure 1-4. Fuel Control System Schematic

c. The overspeed orifice bleeds Py pressure from the governing system of the gas producer fuel control. Bleeding Py pressure at the power turbine governor gives the fuel control system a rapid response to overspeed conditions.

1-14. Fuel Pump and Filter Assembly.

a. The fuel pump and filter assembly (figure 1-5) incorporates a single gear-type pumping element, a low pressure barrier filter, a filter bypass valve, and a bypass pressure regulating valve. Fuel enters the engine fuel system at the inlet port of the pump and passes through the low pressure filter before entering the gear element. The filter bypass valve allows fuel to bypass the filter element if it becomes clogged.

b. The bypass return flow from the fuel control is passed back to the inlet of the gear element through a pressure regulating valve which maintains the bypass flow pressure above inlet pressure. By means of passages leading to auxiliary filling ports on the periphery of the gear element, a portion of the bypass flow is used to fill the gear teeth when vapor-liquid conditions exist at the inlet to the gear element.

c. The 5 micron nominal 10 micron absolute, paper filter is located inside the fuel pump assembly upstream of the gear element. It is retained by a cast cover attached to the pump housing by two socket head cap screws. The cover is located on the aft side of the pump. To minimize fuel spillage during filter replacement, fuel may be drained through the lower of

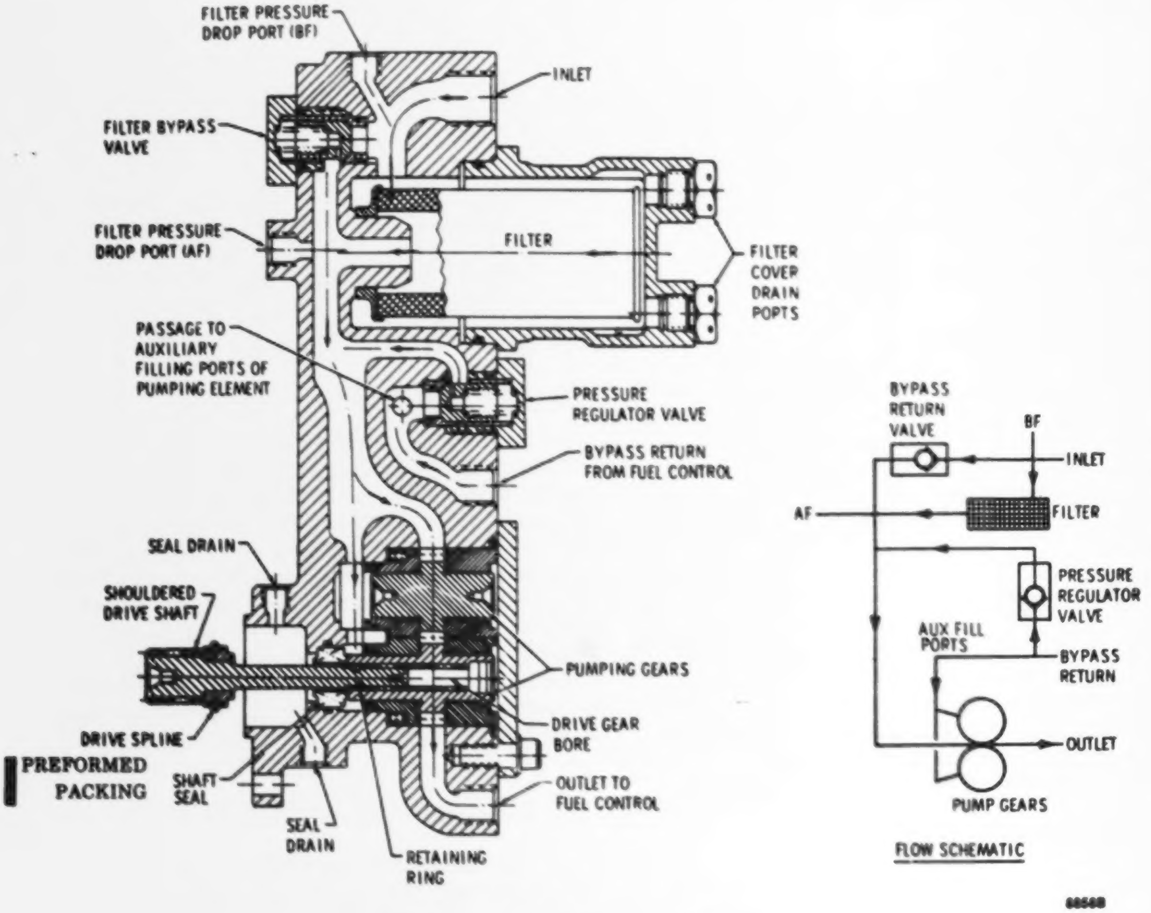

FILTER PRESSURE DROP PORT (BF)
INLET
FILTER BYPASS VALVE
FILTER PRESSURE DROP PORT (AF)
FILTER
FILTER COVER DRAIN PORTS
PASSAGE TO AUXILIARY FILLING PORTS OF PUMPING ELEMENT
PRESSURE REGULATOR VALVE
BYPASS RETURN FROM FUEL CONTROL
SEAL DRAIN
SHOULDERED DRIVE SHAFT
PUMPING GEARS
DRIVE SPLINE
DRIVE GEAR BORE
PREFORMED PACKING
SHAFT SEAL
OUTLET TO FUEL CONTROL
SEAL DRAIN
RETAINING RING
BYPASS RETURN VALVE
BF
INLET
AF
FILTER
PRESSURE REGULATOR VALVE
AUX FILL PORTS
BYPASS RETURN
OUTLET
PUMP GEARS
FLOW SCHEMATIC
6656B

Figure 1-5. Fuel Pump and Filter Assembly

the two drain ports located on the aft face of the filter cover. Pressure taps are provided before and after (labeled BF and AF) the filter element to permit measurement of filter pressure drop if desired.

1-15. Double Check Valve.

The double check valve assembly is a mechanical device placed in the governing pressure (Pg) circuit between the power turbine governor and the main fuel control to dampen surges in the Pg pressure signal. (See figure 1-4.) It incorporates two individual, diaphragm operated valves within one unit. The valves are located in parallel with each other and open in opposite directions. Movement of air through the check valve assembly in either direction is permitted by one of the valves. However, when a stable signal is provided, a very small flow of air is experienced with the valve toward its closed position. Any pressure surges in the Pg signal will be dampened by spring loading on the valve.

1-16. Pc Air Filter.

The Pc air filter is a 10 micron filter located in the Pc air supply line leading from the diffuser scroll to the power turbine governor. It incorporates a permanent type, wire mesh, cleanable element. It prevents the governor and fuel control pneumatic components from being contaminated with foreign particles by filtering Pc air flow to the governor and control.

1-17. Fuel Check Valve.

The fuel check valve is located in the fuel line between the fuel control and the fuel nozzle. It has a cracking pressure of 22-28 psi and serves to prevent leakage of fuel through the fuel nozzle into the combustion chamber if the fuel cutoff valve is inadvertently opened or leaks while the engine is not operating.

1-18. Fuel Nozzle.

The fuel nozzle is a single-entry, dual-orifice type unit. It contains an integral valve for dividing primary and secondary flow. This same valve acts as a fuel shutoff valve when fuel manifold pressure falls below a predetermined pressure, and keeps fuel out of the combustion chamber at shutdown.

1-19. Lubrication System.

The lubrication system is a dry sump type with an external reservoir and heat exchanger. A gear type pressure and scavenge pump assembly is mounted within the power and accessory gearbox. (See figures 1-6 and 1-7.) The oil filter, filter bypass valve, and pressure regulating valve are in a unit which is located in the upper right-hand side of the power and accessory gearbox housing and are accessible from the top of the engine. A check valve is located between the housing and the filter unit. Indicating type magnetic chip detectors are installed at the bottom of the power and accessory gearbox, and at the engine oil outlet connection. All engine oil system lines and connections are internal with the exception of pressure and scavenge lines to the compressor front support, the gas producer turbine support, and the power turbine support.

1-20. Ignition System.

The engine ignition system consists of a low tension capacitor discharge ignition exciter, a spark igniter lead, and a shunted-surface gap spark igniter. The system receives its input power from a 14 to 29-volt, d-c power source.

1-21. Temperature Measurement System.

The temperature measurement system has four chromel-alumel single junction thermocouples in the gas producer turbine outlet (TOT) and an associated integral harness. The voltages of the four thermocouples are electrically averaged in the assembly and delivered by the assembly lead to an engine terminal block for attachment to the airframe temperature indicating system.

1-22. Anti-icing System.

a. Anti-icing is provided for the compressor inlet guide vanes and front support hub by the use of compressor discharge air. The air is taken from a port at the twelve o'clock position on the front face of the diffuser scroll. An anti-icing air shutoff valve is installed in the port and is manually operated from the flight deck to control anti-icing air flow. Anti-icing air tubes direct the flow of air from the valve to fittings on each side of the compressor front support. The air is then routed through an annulus around the OD of the front support and through the inlet guide vanes and is discharged into the inlet air stream.

1-23. Acceleration Bleed Air System.

a. The compressor bleed air system permits rapid engine response. The system has a compressor discharge pressure sensing port on the scroll, tubing from the sensing port to the bleed valve, a compressor bleed

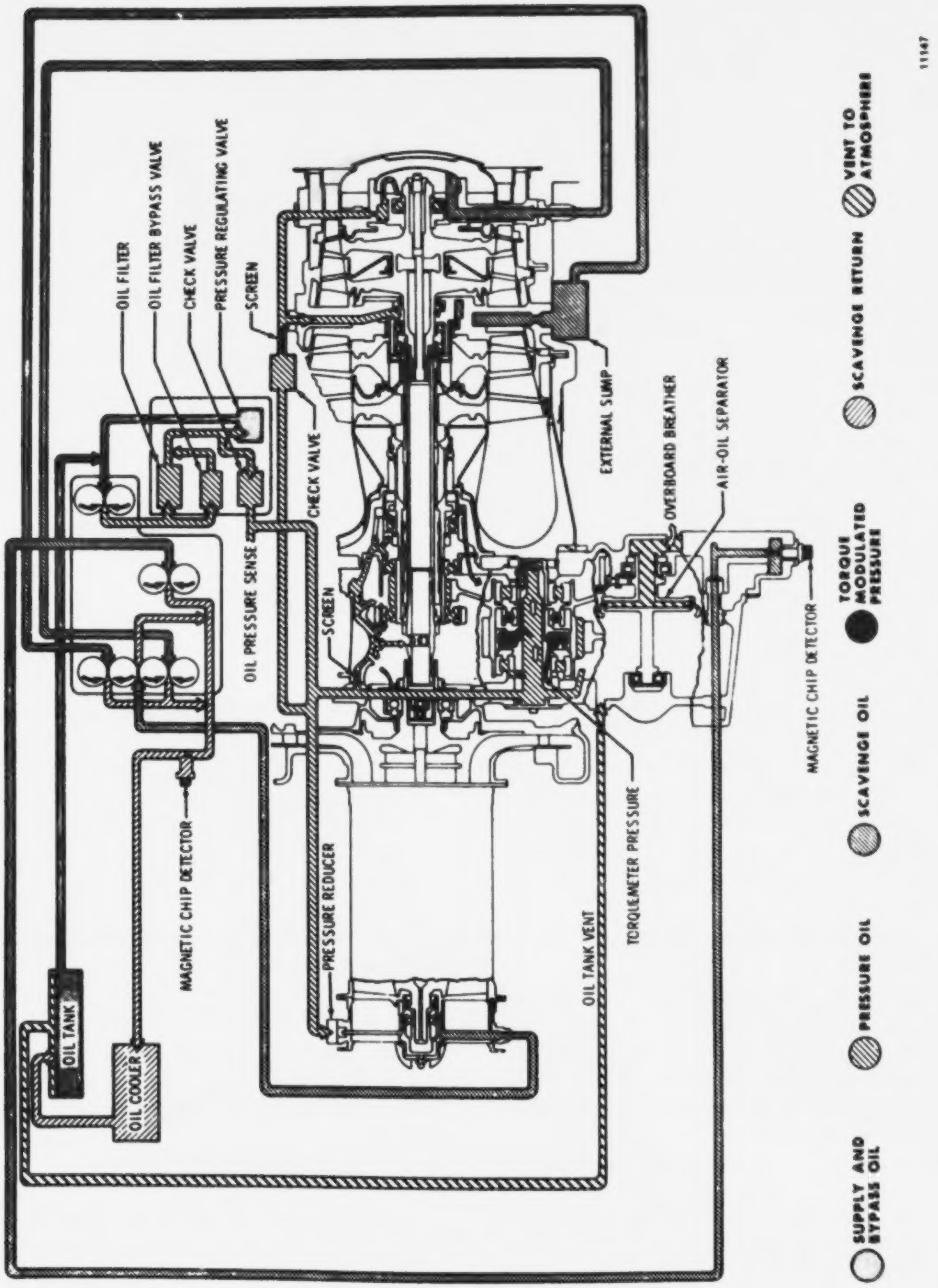

OIL FILTER
OIL FILTER BYPASS VALVE
CHECK VALVE
PRESSURE REGULATING VALVE
SCREEN
CHECK VALVE
OIL PRESSURE SENSE
SCREEN
EXTERNAL SUMP
OVERBOARD BREATHER
AIR-OIL SEPARATOR
MAGNETIC CHIP DETECTOR
TORQUEMETER PRESSURE
OIL TANK VENT
PRESSURE REDUCER
MAGNETIC CHIP DETECTOR
OIL TANK
OIL COOLER
SUPPLY AND BYPASS OIL
PRESSURE OIL
SCAVENGE OIL
TORQUE MODULATED PRESSURE
SCAVENGE RETURN
VENT TO ATMOSPHERE
11147

Figure 1-6. Engine Lubrication System Schematic

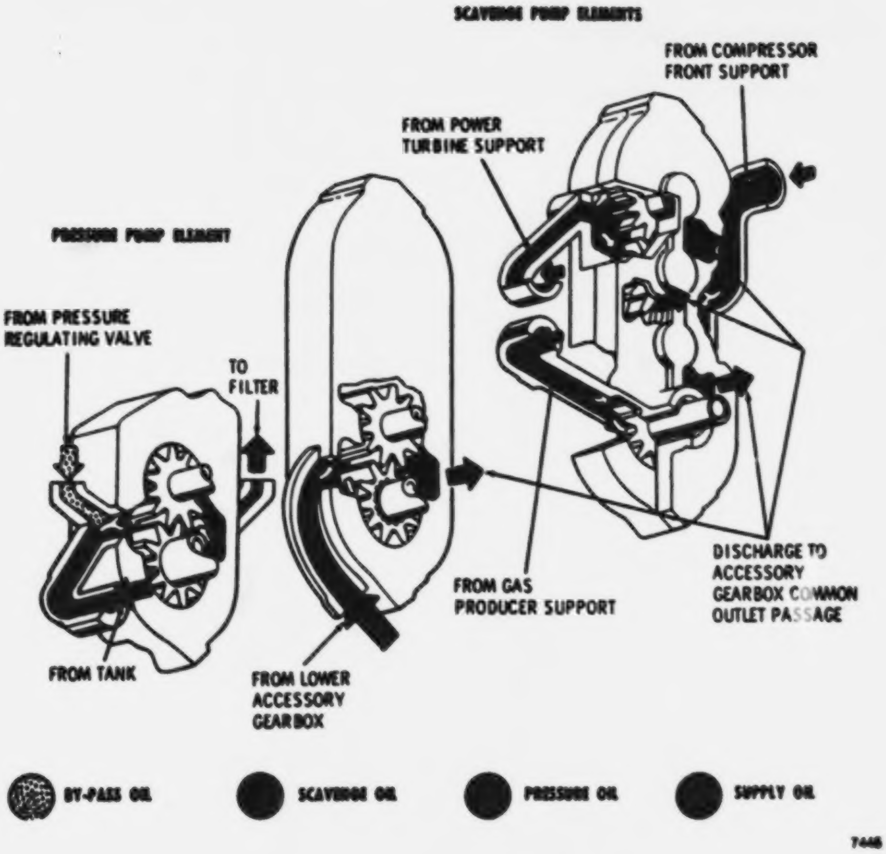

SCAVENGE PUMP ELEMENTS
FROM COMPRESSOR FRONT SUPPORT
FROM POWER TURBINE SUPPORT
PRESSURE PUMP ELEMENT
FROM PRESSURE REGULATING VALVE
TO FILTER
FROM GAS PRODUCER SUPPORT
DISCHARGE TO ACCESSORY GEARBOX COMMON OUTLET PASSAGE
FROM TANK
FROM LOWER ACCESSORY GEARBOX
BY-PASS OIL
SCAVENGE OIL
PRESSURE OIL
SUPPLY OIL
7446

Figure 1-7. Oil Pump Schematic

valve (figure 1-8) and a bleed air manifold on the compressor case.

b. A slot in the compressor wall over the fifth stage blades bleeds compressor air into a manifold, which is an integral part of the compressor case. The manifold forms the mounting flange for the compressor bleed control valve when the compressor case halves are assembled.

c. Compressor discharge air pressure sensing, for bleed control valve operation, is obtained at a sensing port on the compressor scroll. The bleed control valve is normally open; it is closed by compressor discharge pressure. See figure 1-9 for bleed control valve opening and closing speeds.

1-24. Air Bleed Extraction.

Two ports are provided on the diffuser scroll to supply compressor bleed air for aircraft systems. Bleed airflow is limited to four percent of total engine airflow.

1-25. Leading Particulars.

Engine leading particulars are listed in table 1-1. Performance ratings are listed in table 1-2.

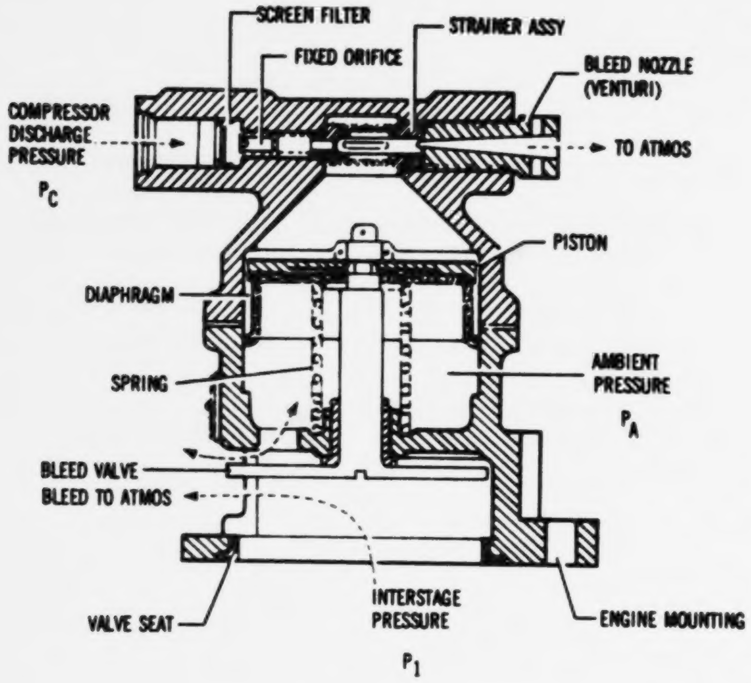

SCREEN FILTER
STRAINER ASSY
FIXED ORIFICE
BLEED NOZZLE (VENTURI)
COMPRESSOR DISCHARGE PRESSURE
P C
TO ATMOS
PISTON
DIAPHRAGM
SPRING
AMBIENT PRESSURE
P A
BLEED VALVE
BLEED TO ATMOS
VALVE SEAT
INTERSTAGE PRESSURE
P 1
ENGINE MOUNTING

Figure 1-8. Compressor Bleed Control Valve

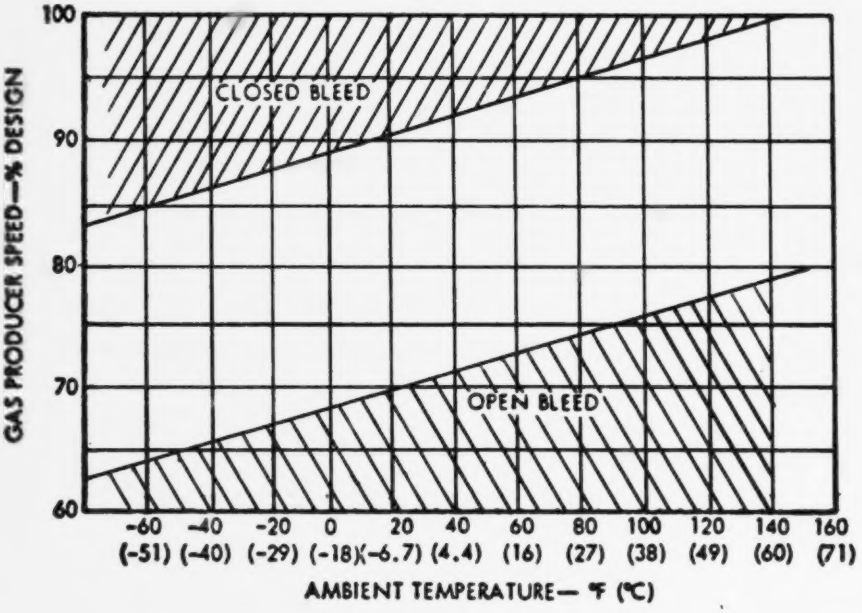


Figure 1-9. Compressor Bleed Control Valve Operation

Table 1-1. Leading Particulars

Dimensions:	
Length	40.7 inches
Height	23.2 inches
Width	19.0 inches
Engine weight (dry)	158 pounds
Maximum oil consumption	0.05 gal/hr
Lubricating oil specifications	MIL-L-23699 or MIL-L-7808
Fuel specifications:	
Primary	MIL-T-5624 (JP-4)
Alternate	MIL-T-5624 (JP-5)
Emergency	MIL-G-5572
Design power output	420 shp
Ram power rating	440 shp
Design speeds:	
Gas producer (N1)	100% (50,970 rpm)
Power turbine (N2)	100% (33,290 rpm)
Power output shaft	100% (6,016 rpm)

Table 1-2. Performance Ratings (Standard Sea Level Static Conditions)

Ratings	**Shaft HP**	**Gas Generator rpm (est)**	**Output Shaft Speed rpm**	**Fuel Flow lb/hr (max)**	**Ram Power Rating Torque at Output Shaft ft-lb (max)**	**Measured Rated Gas Temp. ° C (max)**
Intermediate	420	53000	6016	273	384	810
Max Cont.	370	51200	6016	241	323	738
75% Max Cont.	278	48800	6016	197	323	– –
50% Max Cont.	185	45880	6016	153	323	– –
Ground Idle	35 (max)	33000	4500-6300	70 lbs/hr	– –	425 ± 60
Flight Idle	0	33000	5900-6480	70 lbs/hr	– –	415 ± 60

Intermediate power is the maximum power authorized and is limited to 30 minutes use.

Max Continuous is the highest power authorized for continuous operation.

CHAPTER 2

SPECIAL TOOLS, TEST EQUIPMENT, AND CONSUMABLE MATERIALS

Section I. SPECIAL TOOLS AND TEST EQUIPMENT

2-1. General.

A listing and illustration of special tools and test equipment is presented in this section. This listing provides a convenient reference for special tools and test equipment available to perform maintenance functions on the engine. It is primarily intended as a ready reference for maintenance personnel in determining what equipment is available. All tools and equipment are arranged alphabetically.

Table 2-1. Special Tools and Test Equipment

Figure	Nomenclature	Part number
2-1	Adapter, Engine Turning	6799790 NSN 4920-00-923-3188
2-2	Bracket, Mounting, Compressor Vibration Pickup	6872539
2-3	Clamp, Loop	6799952 NSN 5340-00-945-0244
2-3	Clamp, Loop	6799953 NSN 5340-00-945-0242
2-4	Kit, Protector, Compressor Cleaning	6886204 NSN 4920-01-030-1011
None	Kit, Vibration Signal Source	171170-0104 (FSC 14028) NSN 4920-00-879-0331
2-5	Lift, Engine Assy	6796963 NSN 5120-00-924-7722
2-6	Puller Kit, Mechanical	6796941 NSN 5120-00-945-0186
2-7	Stand, Test, Engine, Modular	LTCT 10465-02 NSN 4920-00-167-9178
2-8	Stand, Turnover, Engine Assembly	6795579 NSN 4920-00-924-5726
None	Stop Watch	NSN 6645-00-250-4680
None	Wrench, Bristol	S1116 NSN 5120-00-134-4942
2-9	Wrench, Ground Idle	6798292 NSN 5120-00-763-7565

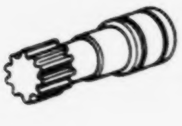


Figure 2-1. Engine Turning Adapter 6799790

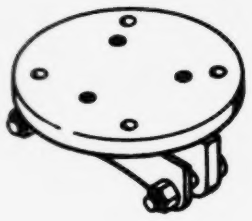


Figure 2-2. Compressor Vibration Pickup Mounting Bracket 6872539

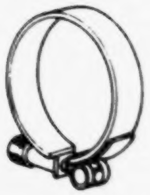


Figure 2-3. Loop Clamps 6799952 and 6799953

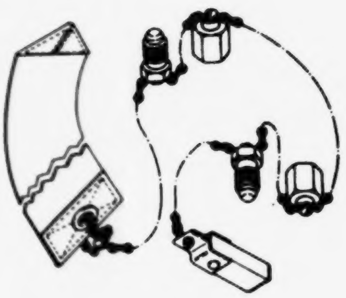


Figure 2-4. Compressor Protector Kit 6886204

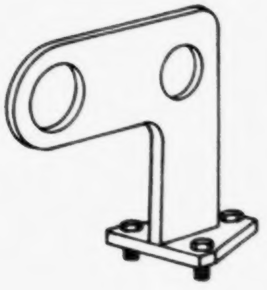


Figure 2-5. Engine Assembly Lift 6796963

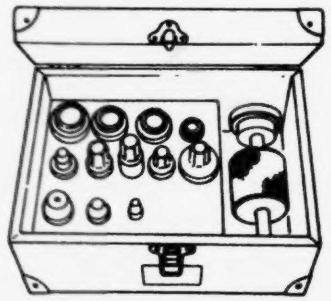
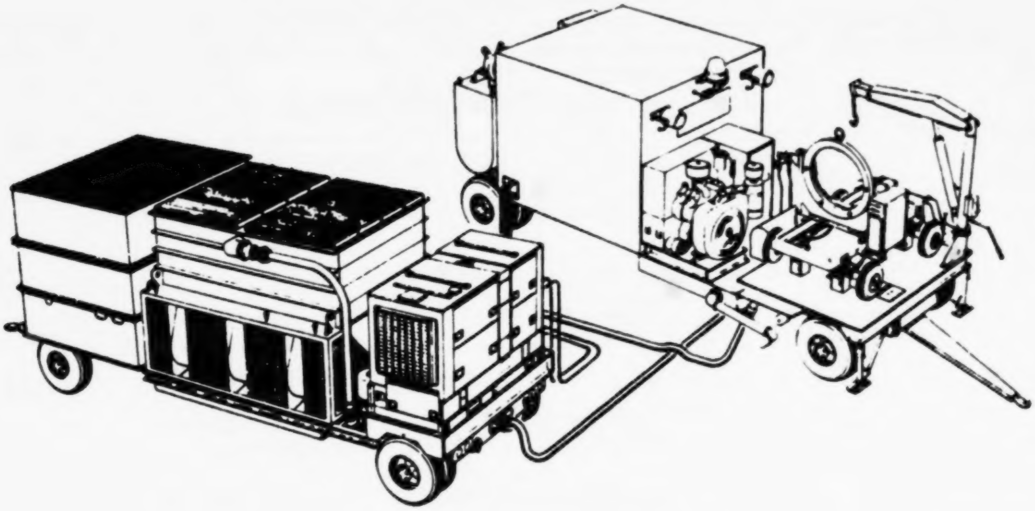
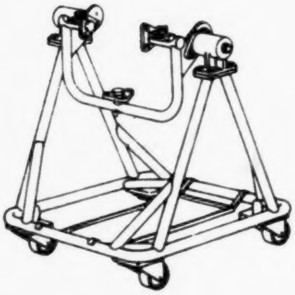


Figure 2-6. Mechanical Puller Kit 6796941



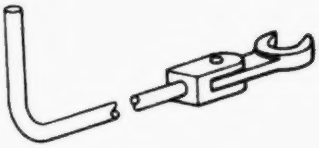
018-0035.0-10

Figure 2-7 Modular Engine Test Stand
LTCT10465-02



9157

Figure 2-8. Engine Assembly Turnover Stand
6795579



5757

Figure 2-9. Ground Idle Wrench
6798292

Section II. CONSUMABLE MATERIALS

2-2. General.

Table 2-2 presents a listing of the consumable materials required to maintain the engine. Consumable materials are supply items which are consumed in use or materials which lose their identity in an assembly.

TABLE 2-2. CONSUMABLE MATERIALS

ITEM NUMBER	LEVEL	NSN	DESCRIPTION	U/M
1	0	8520-00-228-0598	Liquid Soap Solution P-S-624, Type 1 (1 Gal can)	EA
2	0	8030-00-244-1298	Corrosion Preventive Compound MIL-C-16173 Grade 2 (5 Gal can)	EA
3	0	6850-00-264-9038	Dry cleaning solvent P-D-680, Type 1	EA
3A	0	6850-00-274-5421	Dry cleaning solvent P-D-680, Type II (5 Gal can)	EA
4	0	8135-00-282-0565	Barrier Material (Water-vapor proof), MIL-B-131, Class I (3X 600 FT)	EA
5	0	7510-00-074-5124	Tape, pressure sensitive adhesive PPP-T-60, Type IV (2 in. X 60 yds)	EA
6	0	7510-00-227-1444	Ink, stencil marking white, TT-1-1795 (1 qt can)	EA
7	0	9150-00-782-2627	Oil, Lubricating MIL-L-7808 (1 qt can)	EA
8	0	9150-00-985-7099	Oil, Lubricating MIL-L-23699 (1 qt can)	EA
9	0	6810-00-281-2762	Methylethylketone TT-M-261 (5 Gal can)	EA
10	0	9505-00-596-5101	Lockwire 0.020-in. DIA. MS20995C20	EA

TABLE 2-2. CONSUMABLE MATERIALS (CONT.)

ITEM NUMBER	LEVEL	NSN	DESCRIPTION	U/M
11	0	6850-00-181-7139	Dehydrating Agent MIL-D-3464 (16 Unit bag)	EA
12	0	6850-00-209-7230	Corrosion Preventive Compound MIL-L-6529 Type 3 (5 Gal can)	EA
13	0	9150-00-223-4003	Grease, Aircraft MIL-G-3545 (1 pound can)	EA
14	0	9150-00-944-8953	Grease, Aircraft MIL-G-81322 (1 pound can)	EA
15	0	9150-00-543-7220	Compound, Antiseize MIL-L-25681 (1 pound can)	EA
16	0	6850-00-550-5565	Solvent, Turco 4181 MIL-C-16440	EA
17	0	6850-00-803-6420	Compound, Carbon Removal MIL-C-25107 (5 Gal pail)	EA
18	0	6850-00-597-1528	Compound, Cleaning Cresol Base (Turco formula 3097) or equivalent)	EA
19	0	6850-00-209-7230	Rust Preventive MIL-C-6529 Type 3	EA
20	0	9150-00-223-8892	Oil MIL-L-15016	EA
21	0	6850-00-181-7594	Cleaner, Water Soluable (B and B 3100) (5 Gal pail)	EA
22	0	5350-00-246-0338	Abrasive Paper Grade 320	EA

TABLE 2-2. CONSUMABLE MATERIALS (CONT.)

ITEM NUMBER	LEVEL	NSN	DESCRIPTION	U/M
23	0	5350-00-186-8856	Emery Cloth No. 400 Grit	EA
24	0	8010-00-831-5935	Paint Thinner (Saran Chem. Co. Actithane H251	EA
25	0	8010-00-831-5934	Corrosion Resistant Paint Gray (Saran) Chem. Co. Actithane WC100)	EA
26	0	8030-00-105-0270	Antiseize Compound (1 pound can)	EA
27	0	8030-00-209-8005	Antiseize Compound TT-S-1732	EA
28	0	6810-00-184-4796	Acetone	EA
29	0	3439-00-166-9584	Rod, Welding AMS5786	EA
30	0	5350-00-224-7201	Abrasive Paper P-P-101	EA
31	0	9150-00-754-0664	Molykote (Lubri-Bond A)	EA
32	0	9505-00-293-4208	Lockwire 0.032 in. DIA MS20995C32	EA
33	0	9130-00-256-8613	Fuel MIL-T-5624, Grade JP-4	EA
34	0	6810-00-275-6010	Methanol (Grade A or B)	EA
35	0	6850-00-066-2333	Rustlick No. 606 (5 Gal can)	EA
36	0	8030-00-838-7789	WD 40 or equivalent (MIL-C-23411)	16 oz. spray can
37	0	9150-00-273-2388	Lubricating oil (for assembly and preservation only) MIL-L-6081, Grade 1010	EA

CHAPTER 3

PREPARATION FOR SERVICE, STORAGE, AND ENGINE HANDLING

Section I. PREPARATION FOR SERVICE AND STORAGE

3-1. General.

NOTE

The periodic preservation, storage, and activation of engines are prescribed in TM 55-1520-228-23.

This section provides procedures for the preservation, depreservation, and storage of a complete engine assembly. It also contains procedures for the preservation and depreservation of the compressor, fuel pump, gas producer fuel control, and power turbine governor. Weight and dimension data for the shipping containers are shown in paragraph 3-14.

NOTE

All engine operation procedures will be accomplished in accordance with TM 55-1520-235-10.

3-2. Preservation Maintenance.

Preservation maintenance is not representation, but is the regular inspection and replacement of the dehydrating agent. Allow engine awaiting installation to remain in the dehumidified shipping container as long as possible.

3-3. Inspection of Pressurized Containers.

Immediately upon receipt of an engine at an activity and every 90 days (or more frequently) thereafter, check the relative humidity indicator and the internal pressure of the container in accordance with table 3-1.

NOTE

An all blue color in the humidity indicator indicates a safe condition. As moisture content inside the container increases, the indicator color will change from blue to pink. An all pink condition is considered unsafe and indicates that the desiccant must be changed and the container repressurized.

a. If the humidity indicator indicates that the relative humidity is less than 40 percent and the internal pressure is more than 1 psig, no maintenance is necessary until the next regular inspection.

b. If the humidity indicator indicates that the relative humidity is less than 40 percent but the internal pressure is less than 1 psig, the container shall be checked for leakage, using a soap solution (item 1, table 2-2) at all closures. (Refer to TB 55-8100-200-24.) When leakage has been corrected, the container shall be repressurized to the value stated in table 3-1. Use clean dry compressed air. Record date of repressurization and name of activity in appropriate section of engine historical record.

c. If the humidity indicator indicates the relative humidity to be 40 percent or more, an unsafe or corrosive condition exists. Correct as follows:

(1) Depressurize shipping container by opening air filling valve at front of container.

CAUTION

Do not disturb relief valve. Preset pressure valve could be affected.

(2) Allow air pressure to return to zero.

(3) Remove capscrews and nuts that secure container halves together.

(4) Remove cover from container and inspect engine to determine its serviceability. Any presence of corrosion on the inlet, or compressor housings, or on other visible exterior surfaces, or on the compressor or turbine blades or vanes is cause to render the engine as unserviceable.

(5) If engine is found to be serviceable, remove it from container and place it in service or represerve it per paragraph 3-11.

(6) If unserviceable inspect and repair to a like-new corrosion free condition per applicable paragraphs within this manual as authorized by Maintenance Allocation Chart. If not repairable, ship engine to overhaul.

3-4. Removal of Engine From Shipping Container.

WARNING

Prior to removing engine from container, make sure both sections of container are grounded and the container is opened in a well ventilated area. Electrical spark could occur.

NOTE

Before removing the engine from the shipping container, inspect for evidence of rough handling or tampering.

To remove the engine from the shipping and storage container, proceed as follows:

a. Loosen nut (17, figure 3-1) and open cover (19). Remove the engine records from the records receptacle.

b. Loosen two nuts (26) and open cover (31). Loosen air valve (32) and allow the container to depressurize.

WARNING

Make certain that all air pressure has been released before loosening nuts and bolts (1 and 37). If nuts are removed before pressure is released, internal pressure could blow off cover.

c. Remove nuts (1) and bolts (37) from the container splitline and remove cover (2).

CAUTION

Ensure upper half of shipping container does not strike engine when removing cover. Damage to engine could occur.

d. Install engine assembly lift, tool No. 6796963, on the gearbox top mounting pad and attach a hoist. Raise the engine only enough to take the strain off the mounts.

e. Remove four nuts (7), washers (6), and bolts (4) from the engine side mounts. Remove two cotter pins (8), pins (9), and adapters (5) from the engine side mounts.

f. Remove cotter pin (14) and pull out on pin assembly (13) until it disengages from the engine bottom mount.

g. Lift the engine assembly out of the shipping container. Remove the three engine mounting brackets (12) from the engine; these brackets are to remain with the shipping container. Install the three engine mounting brackets supplied with the engine turnover stand, tool No. 6795579, on the engine. Install the engine in the turnover stand.

CAUTION

Do not use the shipping container mounting brackets in lieu of the turnover stand mounting brackets. Brackets are not interchangeable, damage to turnover stand could occur.

h. Place all loose shipping container hardware in the cloth bag supplied with the container and place the bag in the bottom of the container.

i. Remove desiccant from desiccant basket.

j. Install gasket (3) on container base assembly (24).

k. Lower cover assembly (2) into place. Engage the forward end of the cover with the guide pin in the closure flange of base assembly (24); then lower the aft end. Ensure that gasket (3) is properly seated.

l. Install thirty-two bolts (37) and nuts (1) in the closure flange. Bolts (37) shall be inserted from the bottom side of the closure flange. Tighten nuts (1) finger tight. Apply preservative to bolt threads (item 2, table 2-2).

3-5. Engine Depreservation.

a. Remove engine shipping caps, plugs, and covers from the engine as required (see figure 3-2.)

b. Remove the lockwire from the fuel control and governor stops and anti-icing air valve lever.

c. Remove all barrier material and tape. Remove tape residue with solvent (item 3, table 2-2).

d. Remove any corrosion from the exterior surfaces of the engine and touch up paint as required. (Refer to paragraphs 7-25b and 7-29).

NOTE

Flushing of the engine fuel system is not required.

3-6. Inspection of Engine Dropped During Handling

If the engine is dropped during handling, perform the following inspection and tests:

a. Inspect accessory drive gearbox for cracked flanges.

b. Inspect governor and tachometer drive for cracks, distortion, and bent shafts.

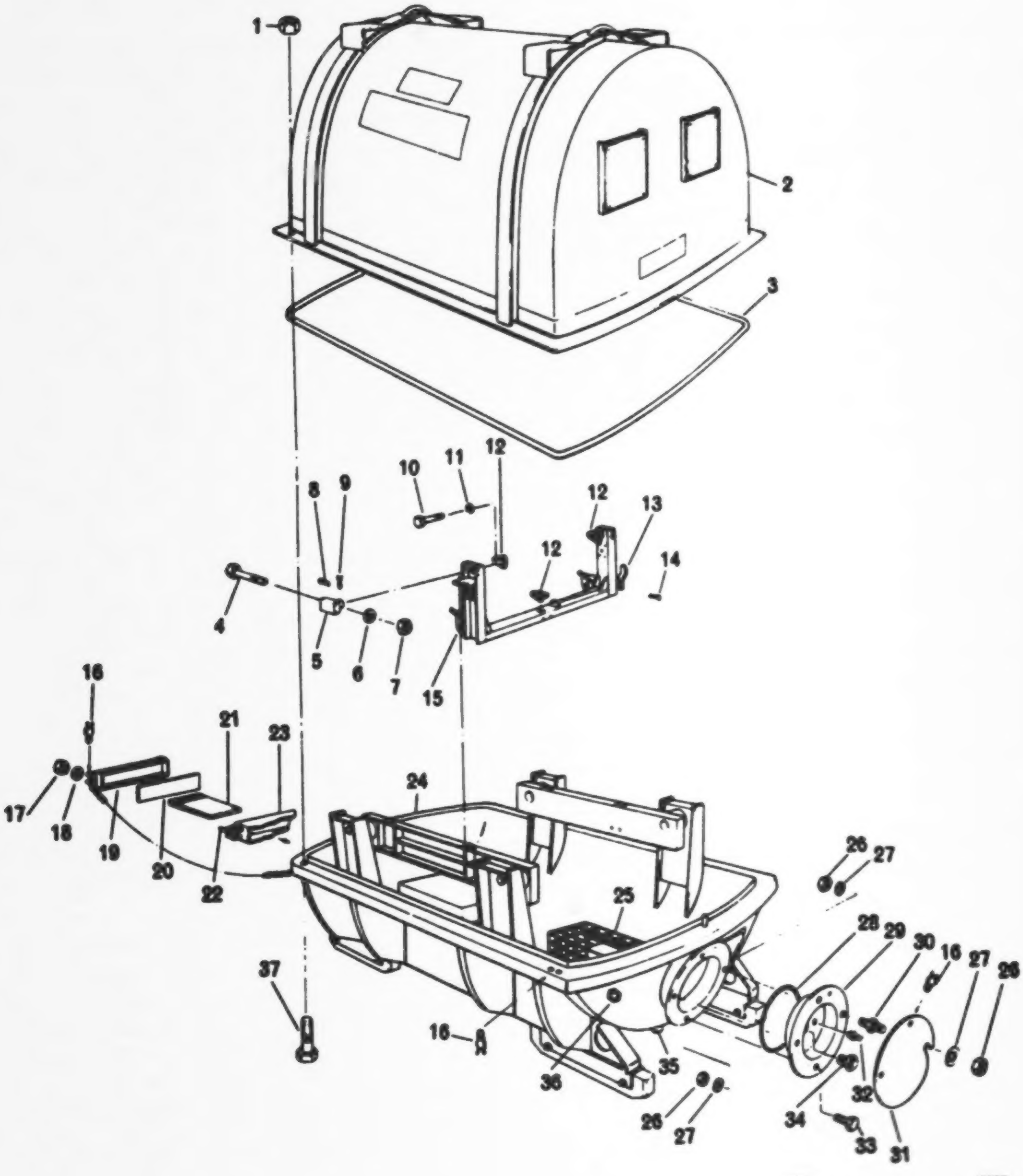
c. Inspect oil filter for damage.

d. Inspect fuel control assembly for cracked flanges.

e. Inspect engine mounting pads for cracks.

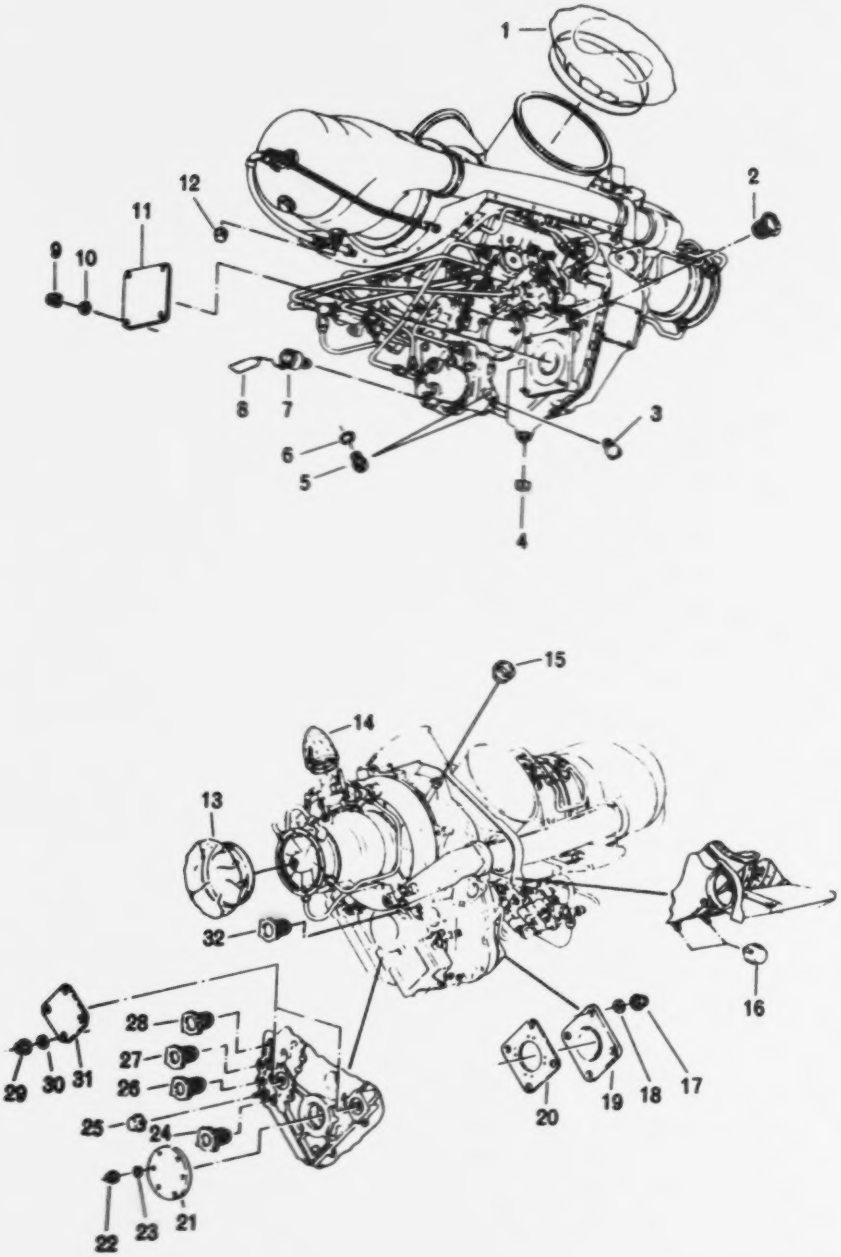
f. Check air, oil, and fuel hose connections for security.

g. Check all accessories for loose bolts, nuts, and connections.


1
2
3
12
10
11
8
9
12
13
12
14
4
5
6
7
15
16
21
23
24
17
18
19
20
22
26
27
25
28
29
30
16
27
26
37
16
36
35
32
34
26
27
33
31
9737

1. Nut
2. Cover assy
3. Gasket
4. Bolt
5. Adapter
6. Washer
7. Nut
8. Cotter pin
9. Pin
10. Bolt
11. Washer
12. Bracket
13. Pin assy
14. Cotter pin
15. Yoke
16. Lead seal
17. Nut
18. Washer
19. Cover
20. Gasket
21. Envelope
22. Stud assy
23. Records receptacle
24. Base assy
25. Basket
26. Nut
27. Washer
28. Preformed packing
29. Service receptacle
30. Bolt
31. Cover
32. Air valve
33. Bolt
34. Relief valve
35. Drain plug
36. Humidity indicator
37. Bolt

Figure 3-1. Engine Shipping Container


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32

1. Exhaust Cover (2)
2. Plug
3. Plug
4. Cap
5. Plug (2)
6. Preformed packing(2)
7. Plug
8. Tag
9. Nut (4)
10. Washer (4)
11. Generator Pad Cover
12. Cap
13. Inlet Cover
14. Bleed Valve Cover
15. Plug
16. Cap (2)
17. Nut (4)
18. Washer (4)
19. Accessory Pad Cover
20. Gasket
21. Output Pad Cover
22. Nut (6)
23. Washer (6)
24. Plug
25. Cap
26. Plug
27. Plug
28. Plug
29. Nut (4)
30. Washer (4)
31. Tach Pad Cover (2)
32. Plug

9055A 14057X

Figure 3-2. Engine Shipping Parts

h. If no visual damage is apparent, engine may be operationally checked either in airframe or in mobile engine test unit. (Refer to Chapter 10.) Minimum test time is 30 minutes and shall include vibration check, coastdown noise check, and post-test inspection of oil filter and chip detectors for metal, lint, or other foreign material. Vibration levels must be within established limits. If no defects are noted, engine is considered serviceable.

i. If engine is unserviceable, it will be preserved in accordance with paragraph 3-8, packed in a metal reusable shipping and storage container (paragraph 3-11), and returned to an overhaul facility. Complete and attach necessary tags to engine; prepare necessary forms and records and place in records receptacle in accordance with paragraph 3-9.

3-7. Accident Engine Preservation.

NOTE

Do not treat an engine for corrosion that has been involved in an accident where engine failure or malfunction is known or suspected to have been a factor. This engine must be held for shipment to an overhaul depot or designated investigation area and should not be treated for corrosion pevention.

a. Without disconnecting lines or fittings, make every effort to prevent the remaining fuel and oil in the engine from leaking out.

b. Seal all openings with covers. (See figure 3-2.) If covers are not available, seal with barrier material (item 4, table 2-2) and secure with tape (item 5, table 2-2).

c. Plug all ports and cap all fittings. (See figure 3-2.

d. Install engine in bottom half of metal reusable shipping and storage container in accordance with paragraph 3-11*b*. Ground engine to container to prevent a possible explosion of dangerous vapors which may be ignited by static electricity or a spark. Secure all loose metal components to the container with tape (item 5, table 2-2) to prevent possible spark during shipment.

3-8. Damaged, Cannibalized, or Failed Engine Preservation.

Inoperable engines that are idle because they require parts or maintenance shall be preserved in accordance with paragraph 3-7*b*, *c*, and *d* and stored in a shipping container or in a clean, dry, area where the engine will be adequately protected from dirt, corrosion, and physical damage.

3-9. Forms, Records, Tags and Stenciling.

a. The forms, records, and reports that are to be used by maintenance personnel when preparing an engine or engine component for storage or shipment are listed in and prescribed by TM 38-750.

b. Authorized tags and the published procedure for their completion is prescribed in TB 750-126. Additional pressurization tags may be applied to assist the maintenance officer in depreservation.

c. Stenciling, labelling and marking of containers for storage and shipment are shown in figures 3-3 and 3-5. Obliterate old markings that do not apply. Letters and numerals of stencils shall be in block letters ½ inch high. Use white stencil ink (item 6, table 2-2). For additional information on marking and stenciling refer to MIL-STD-129.

3-10. Engine Preservation.

A serviceable engine that is being removed from an aircraft for the purpose of storage or return to the overhaul facility will be preserved prior to removal from the aircraft.

a. Ensure that the engine, accessories, inlet duct, plenum chamber, and inlet screens are clean and free from corrosion and foreign material. When external cleaning is necessary, clean with solvent (item 3, table 2-2). (Refer to TB 55-9150-200-24.)

b. Fill the engine oil tank as necessary to normal operating level with standard operating oil (item 7, table 2-2). Start the engine. If available, use external auxiliary power unit (APU).

c. Run at idle to ensure that the engine is operating satisfactorily. Accelerate to 100% N2, collective full down. Operate engine for five minutes or until oil temperature reaches 88°C (191°F), whichever occurs first.

d. Idle engine for two minutes prior to shutting down engine.

e. Allow the engine to cool until the compressor is cool to the touch (bare hand); then preserve the compressor as follows:

(1) Disconnect the fuel system pressure sensing (Pc) tube from the elbow at the diffuser scroll. Cap the tube and the elbow using compressor protector cleaning kit 6886204.

(2) Disconnect the bleed control valve pressure sensing (Pc) tube from the elbow at the diffuser scroll. Cap the tube and the elbow using compressor protector cleaning kit 6886204.

(3) Block the bleed control valve in the closed position using compressor protector cleaning kit 6886204.

(4) Retain the anti-ice valve in the closed position.

(5) Spray one-quarter pint of preservative (item 35, table 2-2) into the engine while it is being motored with the starter and without ignition. Use a sprayer with a quick opening valve and a nozzle sized to spray one-quarter pint of preservative in 1 to 3 seconds. Hold the can or sprayer 8 to 12 inches in front of the compressor. Allow the preservative to be drawn into the compressor while spraying in a circular motion which covers the entire intake area. As an alternate method of application use an aerosol pressure-type spray can. Spray preservative from the can for 15 to 20 seconds while the engine is being motored. Spray in a circular motion which covers the entire intake area.

CAUTION

Do not exceed 10% N1 rpm motoring speed. Do not inject a solid stream of fluid into the compressor, proper compressor preservation may not occur and damage to the compressor vanes could result.

(6) Reconnect the control system and bleed control valve pressure sensing. Tighten coupling nuts to 80-120 lb. in.

(7) Remove the wedge which was used to block the bleed control valve in the closed position.

f. Preserve the engine fuel system as follows:

(1) Disconnect the power input lead at the ignition exciter or pull the IGN ENG circuit breaker (Reference TM 55-1520-235-10). Pull the boost pump circuit breaker.

(2) Disconnect the fuel line at the fuel pump inlet port and connect a source of lubricating oil (item 37, table 2-2). Cap the disconnected fuel line.

(3) Move the twist grip to the IDLE detent and motor the engine with the starter (use APU if available).

CAUTION

To prevent damage to the starter, observe starter time restriction - 35 seconds maximum when temperature is 90°F or (32°C) or above.

(4) Discontinue motoring when fuel-free oil flows from the combustion burner drain valve hose.

(5) Disconnect the source of lubricating oil and cap inlet port of fuel pump.

(6) Reconnect the power lead to the ignition exciter or reset the IGN ENG circuit breaker. Reset the boost pump circuit breaker.

g. Install engine inlet and exhaust protective covers. If covers are not available, seal the openings with barrier material (item 4, table 2-2) and secure with tape (item 5, table 2-2).

h. Make all necessary entries to include the date and extent of engine preservation on the forms (DA Form 2408-13).

i. Remove engine accessories in accordance with Chapter 4 of TM 55-1520-228-23.

j. Clean the starter-generator drive splines with methylethylketone (item 9, table 2-2) as necessary to remove previously applied lubricant. Coat all accessory drive splines and accessory drive pads which do not have accessories installed on them and engine oil shipping plugs (26, 27, 28, figure 3-2) with oil (item 7, table 2-2). Coat fuel inlet shipping plug (7) with oil (item 8, table 2-2). Install shipping plugs, covers, gaskets, washers, and nuts.

k. Secure the gas producer fuel control stop in the cut-off position. Secure the power turbine governor stop and anti-icing valve lever sufficiently tight to prevent movement. Lockwire (item 10, table 2-2) shall be used to secure the stops and lever.

l. Attach a tag (8) to the fuel inlet shipping plug (7) with the following information shown clearly on the tag: THIS FUEL SYSTEM HAS BEEN PREPARED FOR STORAGE BY FLUSHING WITH OIL CONFORMING TO SPECIFICATION MIL-L-6081, GRADE 1010.

m. Touch up paint where damaged in accordance with paragraphs 7-25*b* and 7-29. Do not expose touchup areas to engine fluids or cleaning solvents for a minimum period of 72 hours after application.

n. Tighten aluminum and plastic shpping caps and plugs finger tight; except, tighten caps (12 and 16, figure 3-2) on the combustor drain valve and exhaust collector drain to bottom of cap; then twist an additional 90-120 degrees.

o. Tighten threaded parts to standard torques.

p. Tighten nuts which secure plastic accessory covers as required to obtain a snug fit without excessive cover indentation.

q. Cover the compressor bleed valve with cover (14).

3-11. Installation of Engine Into Reusable Metal Shipping and Storage Container.

All engines which are prepared for storage or shipment will be preserved and packed in a metal reusable shipping and storage container, in accordance with the following procedure.

a. Preparation of Container.

(1) Loosen two nuts (26, figure 3-1) and pivot cover (31) around to expose air valve (32).

(2) Slowly loosen the air valve (32) to relieve pressure in the container.

CAUTION

Personnel should stand clear of air valve when loosening to prevent personal injury.

(3) Remove thirty-two nuts (1) and bolts (37) from the closure flange and remove cover assembly (2).

(4) Remove two cotter pins (8) and pins (9) and remove engine side mounting brackets (12).

(5) Remove cotter pin (14) and slide pin assembly (13) out until it disengages from the engine lower mounting bracket (12). Remove the mounting bracket.

(6) Remove four nuts (7) washers (6), and bolts (4) and remove engine side mounting adapters (5).

(7) Inspect the container to determine that it is complete and serviceable. Particular attention should be given to the mounting brackets, bolts, nuts, pins and cotter pins in the engine suspension system. Replace parts which show signs of wear and/or damage.

b. Installation of Engine In Container.

WARNING

The fuel system of all engines that are to be placed in containers (less accident-involved engines) will be thoroughly drained, purged, and preserved. All disconnected lines will be capped or plugged. Tape will not be used in lieu of caps or plugs.

(1) Suspend the engine from a hoist in the upright position (exhaust ducts up) using engine assembly lift, tool No. 6796963.

(2) Remove the three turnover stand mounting brackets and assemble three engine mounting brackets (12, figure 3-1) on the engine using nine bolts (10) and washers (11). Tighten bolts to 85-110 in. lbs. and lockwire (item 10, table 2-2).

CAUTION

Do not use the engine turnover stand mounting brackets in lieu of engine mounting brackets. Brackets are not interchangeable, damage to engine could occur.

(3) Lower the engine into the container until the bottom mounting bracket (12) engages with the bottom mounting adapter.

(4) Align the pin holes and engage pin assembly (13). Secure with one cotter pin (14).

(5) Insert the two side mounting adapters (5) through the locating holes in yoke assembly (15) and engage with the two side mounting brackets (12). Secure with two pins (9) and cotter pins (8).

(6) Secure the two side mounting adapters (5) to the yoke assembly (15) with four bolts (4) washers (6) and nuts (7). Tighten nuts (7) firmly then loosen one complete turn.

(7) Release the engine weight from the hoist and remove the engine assembly lift, tool No. 679696, from the engine.

(8) Tighten four nuts (7) at the engine side mounts to 40-50 in. lb.

(9) Tie the cloth bag, used to store the engine mounting bolts (10) and washers (11), to desiccant basket (25) for future use.

(10) Place two bags of desiccant (item 11, table 2-2) into desiccant basket (25).

(11) Install gasket (3) on container base assembly (24).

(12) Lower cover assembly (2) into place over the engine. Engage the forward end of the cover with the guide pin in the closure flange of base assembly (24); then lower the aft end. Ensure that gasket (3) is properly seated.

(13) Install thirty-two bolts (37) and nuts (1) in the closure flange. Bolts (37) shall be inserted from the bottom side of the closure flange. Tighten nuts (1) finger tight.

(14) Tighten one nut (1) on each side of the container at the center and at each of the four corners to approximately 75 in. lb.

(15) Starting at the guide pin in the forward end of the closure flange and moving in a clockwise direction, final tighten nuts (1) to 150-165 in. lb.

c. Container Pressurization.

(1) Tighten the air valve (32, figure 3-1).

(2) Using a source of filtered, dry, compressed air, pressurize the container to the value shown in table 3-1.

(3) Check gasket (3), humidity indicator (36), packing (28), drain plug (35), air valve (32), and relief valve (34) for leaks by brushing a liquid soap solution (item 1, table 2-2) on all seams and closure points.

(4) If leaks are found, check torque on nuts (1) and bolts (30, 33). Replace gasket (3) and packing (28) if necessary.

CAUTION

Do not attempt to stop leaks by overtorquing nuts. Overtorquing may cause damage to container.

(5) Repeat steps (2) and (3) as required.

(6) Wipe off or flush away soap solution.

(7) Install cover (31) on bolts (30) and tighten nuts (26) to 15-25 in. lbs.

Table 3-1. Container Air Pressure vs Ambient Temperature

Temperature (%F)	Pressure (psig)	Temperature (%F)	Pressure (psig)
140	7.6	40	3.9
130	7.3	30	3.5
120	6.9	20	3.2
110	6.5	10	2.8
100	6.1	0	2.4
90	5.8	−10	2.0
80	5.4	−20	1.7
70	5.0	−30	1.3
60	4.6	−40	0.9
50	4.3		

d. Engine Records Receptable.

(1) Loosen two nuts (17, figure 3-1) and swing stud assembly (22) out of the slot in cover (19). Pivot the cover out of the way.

(2) Insert applicable engine records in envelope (21) and place in the engine records receptacle.

(3) Pivot cover (19) with gasket (20) into place over the receptacle opening and swing stud assembly (22) into the cover (19) slot.

(4) Secure the cover in palce by tightening two nuts (17) to 30-45 in. lb.

e. Tamper-proof Security.

Container tamper-proof security is provided by five lead seals; two in the container closure flange, two in the records receptacle cover, and one in the service receptacle cover.

(1) Thread seal (16, figure 3-1) wire through the sealing holes in cover (31) and service receptacle (29). Seal the ends of the wire together with the attached lead seal.

(2) Seal both ends of the records receptacle cover (19) by threading seal wire (16) through the sealing holes in cover (19) and receptacle (23). Seal the ends of the wires together with the attached lead seals.

(3) Thread seal wire (16) through each set of sealing holes in the closure flange of base assembly (24) and cover assembly (2). Thread the wire down through one hole and up through the other hole. Secure the ends of the wires together with the attached lead seals. The sealing holes are located at the left front and right rear of container closure flange.

(4) Coat the exposed threads of bolts (30 and 37) and stud assembly (22) with corrosion preventive compound (item 2, table 2-2).

f. Container Stenciling.

Stenciling of the engine shipping container will be in accordance with paragraph 3-9 and figure 3-3.

3-12. Engine Container Internal Pressure and Humidity Check.

Check the internal pressure and humidity within 24 hours after the container is pressurized. Check the pressure and humidity immediately prior to shipment if the engine is to be shipped.

a. Internal Pressure Check. If the internal pressure is not within 0.5 psig of the value shown in table 3-1, repeat paragraph 3-11*c* (2) and (3).

b. Humidity Indicator Check. The humidity indicator (36, figure 3-1) is normally light blue in color. At 40±3 percent relative humidity, the color will change to light lavender or lavender pink.

(1) The humidity indicator may be light lavender or lavender pink when the container is pressurized and should change to light blue within one to two hours. If it does not change to light blue, replace the indicator.

NOTE

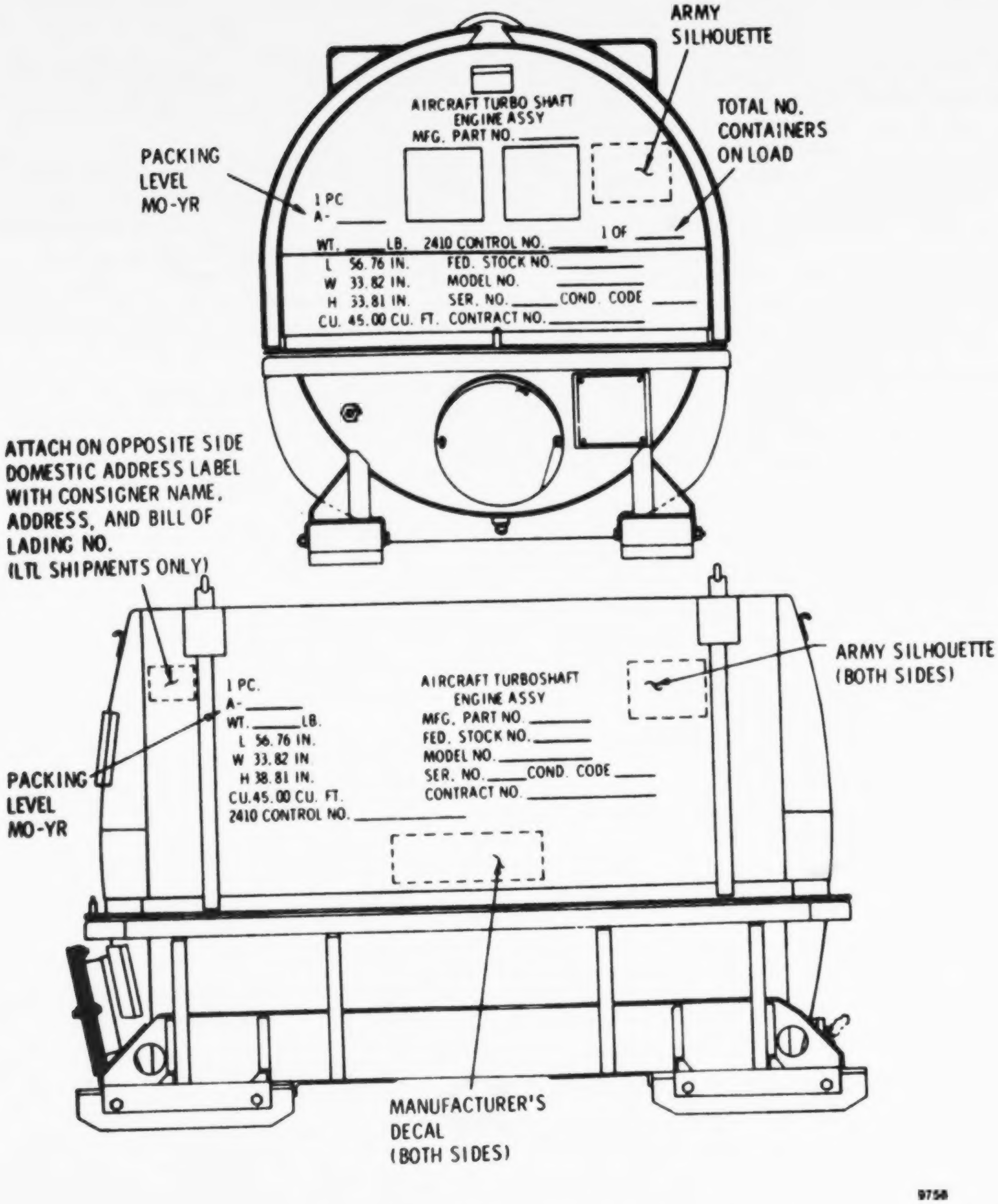
The humidity indicator should change to light blue in an atmosphere of less than 37 percent relative humidity unless it has absorbed sufficient moisture to wash away or destroy its chemical properties.

(2) If the humidity indicator changes to light lavender or lavender pink after the container has been pressurized, open the container and inspect the engine for corrosion. Replace the desiccant (item 11, table 2-2).

3-13. Removing Accessory from Shipping Container

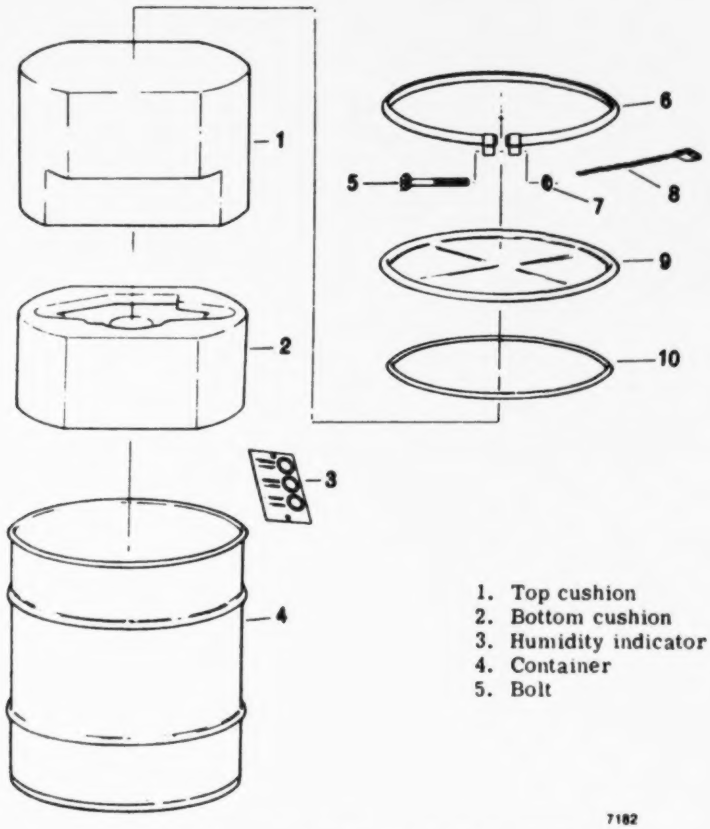
NOTE

Before removing the accessory from the shipping container, inspect for evidence of rough handling or tampering.


ARMY SILHOUETTE
AIRCRAFT TURBO SHAFT ENGINE ASSY
MFG. PART NO. ______
TOTAL NO. CONTAINERS ON LOAD
PACKING LEVEL MO-YR
1 PC
A- ______
WT. ____ LB. 2410 CONTROL NO. ______ 1 OF ______
L 56.76 IN. FED. STOCK NO. ______
W 33.82 IN. MODEL NO. ______
H 33.81 IN. SER. NO. ____ COND. CODE ____
CU. 45.00 CU. FT. CONTRACT NO. ______
ATTACH ON OPPOSITE SIDE DOMESTIC ADDRESS LABEL WITH CONSIGNER NAME, ADDRESS, AND BILL OF LADING NO. (LTL SHIPMENTS ONLY)
ARMY SILHOUETTE (BOTH SIDES)
1 PC.
A- ______
WT. ____ LB.
L 56.76 IN.
W 33.82 IN
H 38.81 IN.
CU.45.00 CU. FT.
2410 CONTROL NO. ______
AIRCRAFT TURBOSHAFT ENGINE ASSY
MFG. PART NO. ______
FED. STOCK NO. ______
MODEL NO. ______
SER. NO. ____ COND. CODE ____
CONTRACT NO. ______
PACKING LEVEL MO-YR
MANUFACTURER'S DECAL (BOTH SIDES)

9758

Figure 3-3. Engine Shipping Container Stenciling and Labeling



1. Top cushion
2. Bottom cushion
3. Humidity indicator
4. Container
5. Bolt
6. Ring
7. Nut
8. Seal
9. Cover
10. Gasket

Figure 3-4. Accessories Shipping Container

a. Loosen nut (7, figure 3-4) and remove the ring (6), cover (9), and gasket (10).

b. Note the condition of the humidity indicator (3).

c. Remove the records and dehydrating agent from the voids on each side of the top cushion (1).

d. Remove top cushion (1).

e. Remove the accessory from the container.

f. Remove all shipping caps, plugs, and covers.

g. Place all shipping parts inside the shipping container (less desiccant) and replace the cover.

3-14. Shipping Container Dimensions and Weight.

The following lists the size, weight, and cubic displacement of the engine, fuel pump, gas producer fuel control, and the power turbine governor shipping and storage containers.

a. Engine Container

Length	57 in.
Width	34 in.
Height	39 in.
Weight (with engine)	600 lb.
Cubic Displacement	45 cu ft

b. Fuel Pump and Filter Assembly Container

Height	15 in.
Diameter	14 in.
Weight (with fuel pump)	24 lb.
Cubic Displacement	1.3 cu ft

c. Gas Producer Fuel Control Container

Height	12¾ in.
Diameter	10½ in.
Weight (with fuel control)	16 lb.
Cubic Displacement	0.8 cu ft

d. Power Turbine Governor Container

Height	12¾ in.
Diameter	10½ in.
Weight (with governor)	13 lb.
Cubic Displacement	0.8 cu ft

3-15. Preparing Fuel Pump and Filter Assembly for Storage and Shipment.

NOTE

The procedure for removing the fuel pump and filter assembly from the metal shipping and storage container is prescribed in paragraph 3-13.

Prepare the fuel pump and filter assembly for storage, shipment, and installation in a metal shipping and storage container, MS63052-1, as follows:

a. Clean the exterior of the fuel pump with a clean cloth dampened with solvent (item 3, table 2-2). Air dry or wipe with a clean lint-free cloth. Blow out all crevices with dry, filtered, low-pressure compressed air.

b. Pump lubricating oil (item 37, table 2-2) into fuel inlet port unitl fuel-free oil flows from the outlet port. Drain excess oil from the fuel pump.

NOTE

If the engine fuel system was preserved in accordance with paragraph 3-10, subparagraph *b* above may be omitted.

c. Install shipping plugs in all ports to prevent entry of foreign material.

d. Coat external bare metal surfaces including the splines with corrosion preventive compound (item 12, table 2-2).

e. Attach a tag to the fuel pump stating: FUEL PUMP PRESERVED WITH LUBRICATING OIL, MIL-L-6081, GRADE 1010.

f. Attach a properly filled out DD FORM 1577-2 (Unserviceable-Reparable tag). Refer to paragraph 3-9 for additional information concerning tags.

g. Prepare DA FORM 2410 (Component Removal and Repair/Overhaul Record) according to TM 38-750 and place in a greaseproof envelope (Refer to paragraph 3-9).

h. Wrap the fuel pump with barrier material (Item 4, table 2-2) to prevent contact with the cushioning material and to prevent the loss of the corrosion preventive compound. Secure barrier material with pressure-sensitive tape (item 5, table 2-2).

i. Prepare the container for use as follows:

(1) Loosen nut (7, figure 3-4) and remove the ring (6), cover (9), gasket (10), and top cushion (1) from body (4).

(2) Check gasket (10) for damage or deterioration and replace if necessary.

(3) Check the container for cleanliness and general condition.

j. Install the fuel pump in the container as follows:

(1) Install the fuel pump upright in the container. Ensure that it is properly seated in the bottom cushion (2, figure 3-4).

(2) Install top cushion (1) in the container. Ensure that it is properly seated over the pump.

(3) Place two bags of dehydrating agent (item 11, table 2-2) in the voids on each side of top cushion (1)—one bag per side.

(4) Place the fuel pump assembly records in one of the voids at the side of the top and bottom cushions. Tape the three-spot humidity indicator card (3) on the side of the top cushion.

(5) Place gasket (10) on cover (9). Install the cover on body (4) and secure with ring (6).

(6) Slowly tighten nut (7) while tapping on the locking ring until 65-75 in. lb. torque is obtained. Secure the nut with wire seal (8).

k. Stencil the container in accordance with paragraph 3-9 and figure 3-5.

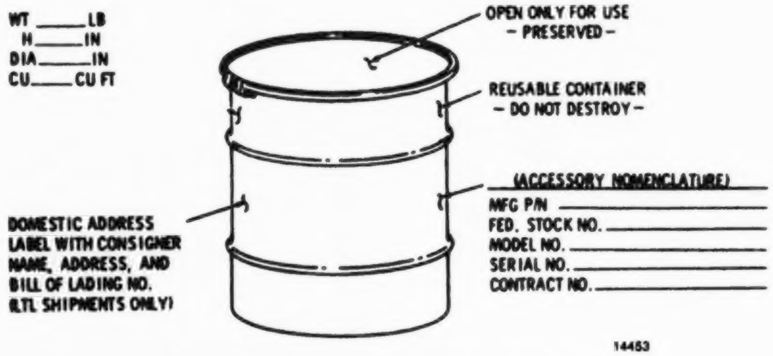


Figure 3-5. Accessories Shipping Container Stenciling

3-16. Preparing Gas Producer Fuel Control for Storage and Shipment.

NOTE

The procedure for removing the gas producer fuel control from the metal shipping and storage container is prescribed in paragraph 3-13.

Prepare the gas producer fuel control for storage, shipment, and installation in a metal shipping and storage container, MS 63048-1, as follows. The fuel control consists of an air section and a fuel section; each section must be treated separately when preparing the unit for storage and shipment.

CAUTION

Do not permit fuel or oil to enter the drive body cavity or any air pressure ports. Damage to fuel control could result.

a. Install shipping plugs in the compressor discharge pressure, governing pressure, Py air pressure, and regulated air pressure ports. (See figure 3-6).

b. Drain residual fuel from the fuel control. Place the throttle lever against the maximum stop. Pump/pour lubricating oil (item 37, table 2-2) into the inlet port. When clean oil flows out of bypass and fuel outlet ports, remove the source of oil. Plug the inlet, bypass and outlet ports. Reposition the throttle lever for shipping.

NOTE

If the engine fuel system was preserved in accordance with paragraph 3-10, subparagraph *b* above may be omitted.

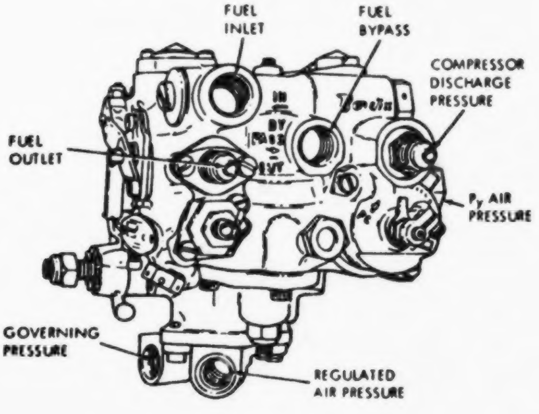


Figure 3-6. Gas Producer Fuel Control Ports Identification

c. Clean the exterior of the fuel control with a clean cloth dampened with solvent (item 3, table 2-2). Air dry or wipe with a clean lint-free cloth. Blow out all crevices with dry, filtered, low-pressure compressed air.

d. Coat external bare metal surfaces including the splines with corrosion preventive compound (item 12, table 2-2).

e. Attach a tag to the fuel control stating: FUEL CONTROL PRESERVED WITH LUBRICATING OIL, MIL-L-6081, GRADE 1010.

f. Attach a properly filled out DD Form 1577-2 (Unserviceable-Reparable tag). Refer to paragraph 3-9 for additional information concerning tags.

g. Prepare DA Form 2410 (Component Removal and Repair/Overhaul Record) according to TM 38-750 and place in a greaseproof envelope. (Refer to paragraph 3-9).

h. Wrap the fuel control with barrier material (item 4, table 2-2) to prevent contact with the cushioning material and to prevent the loss of the corrosion preventive compound. Secure barrier material with pressure-sensitive tape (item 5, table 2-2).

i. Prepare the container for use in accordance with paragraph 3-15i.

j. Install the fuel control upright in the container in accordance with paragraph 3-15j.

k. Stencil the container in accordance with paragraph 3-9 and figure 3-5.

3-17. Preparing Power Turbine Governor for Storage and Shipment

NOTE

The procedure for removing the power turbine governor from the metal shipping and storage container is prescribed in paragraph 3-13.

Prepare the power turbine governor for storage, shipment, and installation in a metal shipping and storage container, MS 27684-2, as follows:

CAUTION

Use extreme care to prevent foreign material from entering the pneumatic tubes or the governor ports. Internal damage to the governor could result.

a. Install shipping plugs in all the ports to prevent entry of foreign material.

b. Clean the exterior of the governor with a clean cloth dampened with solvent (item 3, table 2-2). Air dry or wipe with a clean lint-free cloth. Blow out all crevices with dry, filtered, low-pressure compressed air.

c. Coat external bare metal surfaces including the splines with corrosion preventive compound (item 12, table 2-2).

d. Attach a properly filled out DD Form 1577-2 (Unserviceable-Reparable tag). Refer to paragraph 3-9 for additional information concerning tags.

e. Prepare DA Form 2410 (Component Removal and Repair/Overhaul Record) according to TM 38-750 and place in a greaseproof envelope. (Refer to paragraph 3-9.)

f. Wrap the governor with barrier material (item 4, table 2-2) to prevent contact with the cushioning material and to prevent the loss of the corrosion preventive compound. Secure barrier material with pressure-sensitive tape (item 5, table 2-2).

g. Prepare the container for use in accordance with paragraph 3-15*i*.

h. Install the governor upright in the container in accordance with paragraph 3-15*j*.

i. Stencil the container in accordance with paragraph 3-9 and figure 3-5.

Section II. ENGINE HANDLING

3-18. Scope.

This section provides instructions for installation of the engine in the turnover stand and dismantling of the engine into major functional assemblies.

3-19. Installing Engine in Turnover Stand.

a. Install engine assembly lift, tool No. 6796963 on the gearbox top mounting pad and suspend the engine from a hoist.

NOTE

Do not use the shipping container or airframe mounting backets in lieu of the turnover stand mounting brackets.

b. Install the three turnover stand, tool No. 6795579, mounting brackets on the gearbox side and bottom mounting pads. (See figure 3-7.)

c. Lower the engine into the turnover stand. Ensure that the three mounting brackets installed on the gearbox engage the mounting bosses on the turnover stand.

d. Slide the two clamps at the gearbox side mounts in to engage the mounting brackets and tighten the hand knobs.

e. Remove the hoist and lifting tool.

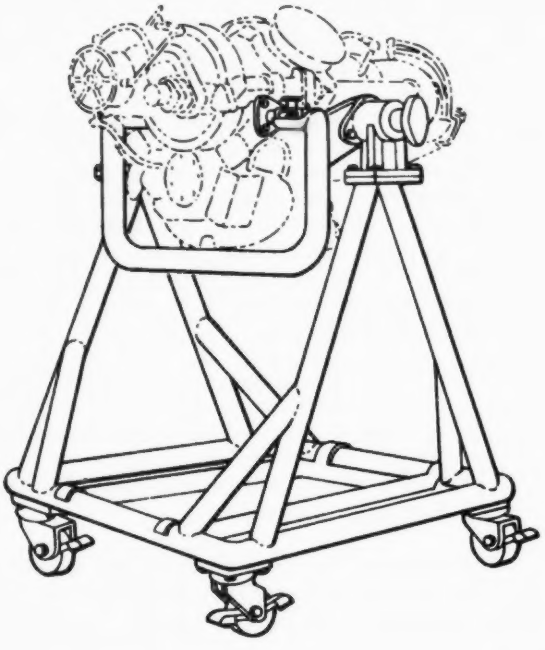


Figure 3-7. Engine Assembly Turnover Stand No. 6795579

3-20. Dismantling Engine Into Major Functional Assemblies

a. During dismantling, examine all major functional assemblies for serviceability. The condition of an assembly can often be better determined by examination during dismantling. Signs of scoring, burning, and excessive wear or the presence of metal particles are danger signals. Thorough inspection should be made immediately. Look for any indications of work incorrectly performed during previous maintenance or overhaul. Report any such indications to the local maintenance officer.

b. Care must be exercised to prevent the entrance of dirt and other foreign material into the engine. Whenever practicable, temporary covers should be used to seal all openings in the dismantled engine. All threads, splines, and pilot diameters should be protected against damage. Protective covers should be of a configuration that prohibits assembly with mating parts without removing the covers.

c. Unless parts of a particular engine are to be held for a special inspection, discard all gaskets, lockwashers, preformed packings, diaphragms, and cotter pins as they are removed. These parts must not be mixed with new parts of similar type and must not be used again. Disposition of self-locking nuts shall be determined in accordance with minimum prevailing torque at reassembly.

WARNING

Prolonged contact with lubricating oil (item 7, table 2-2) may cause a skin rash. Those areas of skin and clothing that come in contact with lubricating oil should be thoroughly washed immediately. Enclosed areas where lubricating oil is used should be adequately ventilated to keep mist and fumes to a minimum.

CAUTION

Lubricating oil may soften paint upon contact. If lubricating oil is spilled on painted surfaces, these surfaces should be thoroughly washed.

d. Remove the magnetic drain plug from the bottom of the gearbox and allow oil to drain before the engine is rotated in the turnover stand.

3-21. Combustion Section Removal.

a. Disconnect the drain hose from the burner drain valve (14, figure 3-8).

b. Remove the lockwire, remove jam nut (16) and disengage bracket (15) from the engine.

WARNING

To prevent personnel injury due to electrical shock, ensure ignition system has been off for at least five minutes before disconnecting the igniter lead. Ground the lead to the engine using an insulated screwdriver to dissipate any energy stored in the exciter.

c. Disconnect the igniter lead (9) from the spark igniter (10).

d. Remove fuel hose (8) between the firewall shield and fuel nozzle (7).

e. If a new outer combustion case (6) is to be installed:

(1) Remove fuel nozzle (7) and spark igniter (10) from outer combustion case (6).

(2) Remove drain valve (14) and plug (12) from the bottom of outer combution case (6). Discard preformed packing (11, 13).

f. Remove the two retaining rings (17) from outer combustion case (6) and slide them forward on the discharge air tubes (18).

g. Remove 24 nuts (5), one clamp (4) and 24 bolts (1, 2) at the combustion case splitline.

h. Remove outer combustion case (6) and air tubes (18). Separate the air tubes from the outer combustion case.

i. Remove combustion liner (3) from the engine.

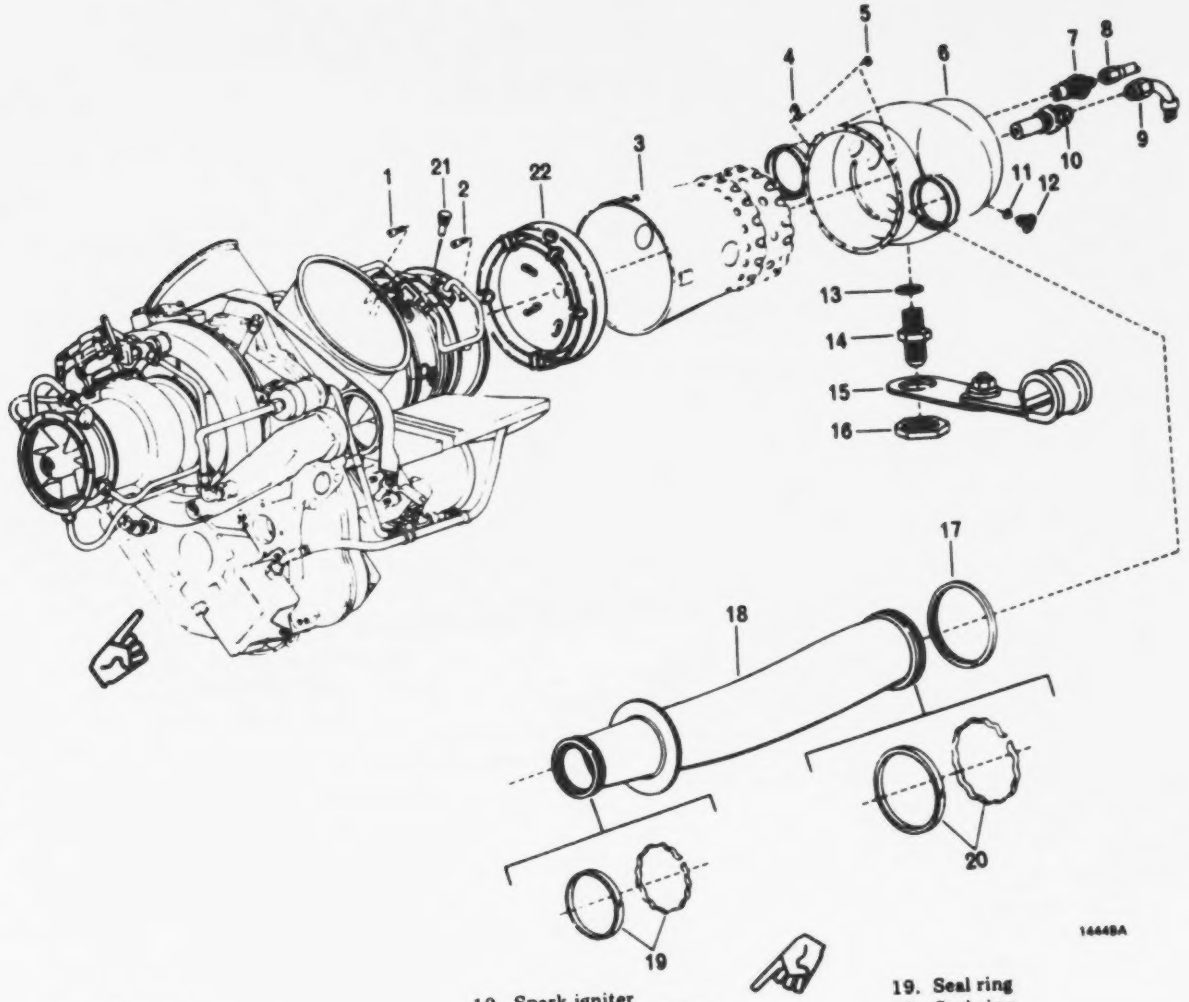
j. Remove seal rings (19) from the small ends of the air tubes.

k. Remove retaining rings (17) and seal rings (20) from the large ends of the air tubes.

NOTE

If a turbine overtemperature inspection is to be made, complete step *l*.

l. Remove lockwire and two positioning plugs (21). Lift off first stage turbine nozzle shield (22).


5
4
6
7
8
9
10
11
12
3
1
21
2
22
13
14
15
16
17
18
20
19
14448A

1. Bolt
2. Bolt (23)
3. Combustion liner
4. Clamp
5. Nut (24)
6. Outer combustion case
7. Fuel nozzle
8. Fuel hose
9. Igniter lead
10. Spark igniter
11. Preformed packing
12. Plug
13. O-ring
14. Drain valve
15. Bracket
16. Jam nut
17. Retaining ring
18. Compressor discharge air tube
19. Seal ring
20. Seal ring
21. Plug
22. First-stage nozzle shield

Figure 3-8. Combustion Section Removal

CHAPTER 4

TROUBLESHOOTING

4-1. General.

a. The troubleshooting procedures in this chapter are presented as a guide for locating and correcting malfunctions. Use of these procedures will reduce delays and maintenance down time and will minimize unnecessary replacement of engine components. Two basic assumptions have been made in preparing these procedures; (1) the correct operating procedures have been followed and (2) the problem is caused by a single failure or malfunction.

b. The troubleshooting procedures are organized under three basic heading; (1) Trouble, (2) Probable cause, and (3) Remedy.

c. The trouble as reported by the flight crew is the main point of the problem. Obtain as much information as possible from the flight crew and their report. In many cases, this information will define the problem completely; however, the malfunction should be confirmed by a ground run, providing there is no danger of possible engine damage occurring.

d. The probably cause lists the components which might cause the malfunction. The cockpit indications can often give a clue as to which of these components is causing the problem.

e. Caution must be exercised to avoid troubleshooting difficulties caused by false cockpit indications. In most cases, a false indication can be detected by checking it against other indications. For example, a TOT indication system malfunction should be suspected if TOT is high, low, or fluctuating with no change in fuel flow or torque.

f. The remedy lists the action to be taken to correct the malfunction.

g. It is not possible to list troubleshooting procedures for every malfunciton which can occur. There will be situations encountered for which there are no applicable procedure but the methods and principles used in the procedures are effective in all maintenance problems.

Table 4-1. Troubleshooting

Item	Trouble	Probable cause	Remedy
1	Engine fails to reach light off cranking speed.	a. Inadequate starter torque caused by low battery or defective starter-generator.	a(1). Check battery. a(2). Check for loose cables. a(3). Check starter-generator and replace if defective. (Refer to TM 55-1520-228-23.)
		b. B and C leads on starter-generator terminal block reversed.	b. Reverse B and C leads.
		c. N1 binding.	c. Replace engine. (Refer to TM 55-1520-228-23.)
2	Engine fails to light off —fuel vapor coming out of exhaust and no audible ignition operation.	a. Preservative oil fouling spark igniter.	a. Try a second start.
		b. Faulty circuit to ignition exciter.	b. Check input power to exciter. If no power, isolate defective component and correct fault.

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
2 (cont)		c. Failed spark igniter.	c. Replace igniter. (Refer to para 5-36.)
		d. Failed ignition exciter.	d. Replace exciter. (Refer to para 5-35.)
		e. Spark igniter firing intermittently.	e. Check input voltage to exciter. If voltage is low, check battery. If voltage is not low, replace exciter.
3	Engine fails to light off —vapor coming out of exhaust and ignition operation audible.	Water or other contaminants in fuel.	Check a sample of fuel from the bottom of the tank. If contaminated, defuel the tank (Refer to TM 55-1520-228-23). Disconnect fuel line at the fuel nozzle then flush the system with clean fuel. Install new filters in the fuel pump and fuel control.
4	Engine fails to light off —no fuel vapor coming out of exhaust.	a. No fuel in tanks.	a. Fill tanks with fuel.
		b. Insufficient fuel pressure to engine fuel pump.	b. Turn on aircraft boost pump.
		c. Gas producer fuel control in cutoff position.	c. Check linkage.
		d. Fuel pump inoperative.	d(1). Check pump for sheared drives or internal damage and replace as required. (Refer to para 5-9). d(2). Check for air leaks at pump inlet.
		e. Fuel nozzle valve stuck.	e. Replace nozzle. (Refer to para 5-15).
		f. Fuel nozzle orifice clogged.	f(2). Check fuel filter. (Refer to para 5-10.) f(2). Replace nozzle. (Refer to para 5-15.)
		g. Air fuel lines.	g. Bleed system and try a second start.
		h. Defective ignition switch.	h. Check wiring and/or replace defective part.
5	Engine lights off but will not accelerate to idle speed in 45 seconds.	a. Inadequate starter torque caused by low battery or defective starter-generator.	a. Check condition of battery and starter-generator to determine if sufficient N1 cranking speed is attainable.

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
5 (cont)		b. Air leaks in control air tubing.	b. Check air tubes and fittings for looseness or cracks. Replace or tighten tubes and fittings as required.
		c. Cracked accumulator(s).	c. Replace as required. (Refer to para 5-16.)
		d. Sticking double check valve.	d. Replace valve. (Refer to para 5-14.)
		e. Pc filter clogged.	e. Check and clean Pc air filter. (Refer to para 5-11.) Clogging may be caused by dirt, moisture, or ice.
		f. Cracks in compressor discharge air tubes or outer combustion case.	f. Weld repair or replace parts as applicable.
		g. Compressor discharge air tube seal leaks.	g. Replace air tube seals. (Refer to para 3-21.)
		h. Insufficient fuel supply to gas producer fuel control.	h. Check fuel system to ensure all valves are open and pumps are operative.
		i. Insufficient fuel pressure to fuel pump.	i. Turn on aircraft boost pump.
		j. Anti-icing valve open and cabin heat on.	j. Close anti-icing valve and turn off cabin heat.
		k. Gas producer fuel control start derichment too lean.	k. Adjust start derichment. (Refer to para 5-12.)
		l. Gas producer fuel control bypass valve stuck open.	l. Disconnect the fuel line at the fuel nozzle, flush system with clean fuel. If the same condition still exists, replace fuel control. (Refer to para 5-12.)
		m. Gas producer fuel control incorrectly adjusted or calibration has shifted.	m. Replace control. (Refer to para 5-12.)
		n. Fuel nozzle partially clogged with carbon.	n. Clean fuel nozzle. (Refer to para 5-15.)
		o. Fuel nozzle check valve stuck partially open.	o. Replace fuel nozzle. (Refer to para 5-15.)
		p. Faulty power turbine governor.	p. Replace governor. (Refer to para 5-13.)
		q. Dirty compressor.	q. Clean compressor. (Refer to para 7-3.)
		r. Foreign object damage or erosion to compressor.	r. Inspect compressor. (Refer to para 7-9 or 7-10.)

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
6	Acceleration temperature too high during start.	a. Insufficient time allowed for draining after an unsuccessfull starting attempt.	a. Purge the engine by motoring with the gas producer lever and ignition switch in OFF for approximately 10 sec before attempting a second start.
		b. Reduced battery capacity. This can produce low cranking speed.	b. Recharge battery, replace battery. (Refer to TM 55-1520-228-23.)
		c. High residual TOT in excess of 150°C (302°F).	c. Motor engine with starter leaving gas producer lever and ignition OFF.
		d. Depreciated starter which is not capable of dry motoring gas producer (N1) above 15 percent.	d. Replace starter. (Refer to TM 55-1520-228-23.)
		e. Gas producer lever (twist grip) in ground idle (start) position prior to and during starter engagement.	e. Review starting procedure.
		f. Dirty compressor.	f. Clean compressor. (Refer to para 7-3).
		g. Fuel nozzle valve stuck full open.	g. Replace fuel nozzle. (Refer to para 5-15.)
		h. Excessive compressor air leaking.	h. Check for leaks. Be sure that anti-ice valve is fully closed.
		i. Bleed control valve stuck closed.	i. Replace bleed control valve. (Refer to para 5-33.)
		j. Gas producer fuel control incorrectly adjusted or calibration has shifted.	j. Inspect turbine and replace faulty control if start temperature exceeds 927°C (1700°F).
		k. Gas producer fuel control start derichment too rich.	k. Adjust start derichment. (Refer to para 5-12.)
		l. Engine fuel pump.	l. Replace fuel pump.
		m. Fuel control not in cutoff.	m. Check rigging.
7	Acceleration temperature too low during starting.	a. Fuel control system air sensing lines leaking.	a. Check air lines and fittings for leaks.
		b. Gas producer fuel control start derichment too lean.	b. Adjust start derichiment (Refer to para 5-12.)
		c. Gas producer fuel control incorrectly adjusted or calibration has shifted.	c. Replace control. (Refer to para 5-12.)
8	Engine speed cycles at idle.	a. Gas producer fuel control bypass valve not operating freely.	a. Disconnect the fuel line at the fuel nozzle; flush system with clean fuel. Replace the fuel control fuel filter. (Refer to para 5-12.) If the same condition still exists, replace control. (Refer to para 5-12.)

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
8 (cont)		b. Check rigging.	b. Refer to para 5-12.
9	Engine unstable above idle speed.	a. Leak(s) in fuel system air tubes.	a. Correct leak(s), then test in accordance with para 5-8.
		b. Contamination in the pneumatic section of the gas producer fuel control and power turbine governor.	b. Check Pg port in the governor and the Pc port in both control and governor. Replace control or governor if contaminated. (Refer to para 5-12 and 5-13.)
		c. Defective fuel control or governor.	c. Isolate the governor from the system by removing the tee fitting from the governor Pc port and capping the governor end of the tee. Plug the open governor port to prevent entry of dirt. Start the engine and carefully accelerate to 100% N2 and check stability. If the engine is unstable, replace the fuel control; if stable, replace the governor. (Refer to para 5-12 and 5-13.)
		d. Accumulator(s) leaking.	d. Replace accumulator(s).
		e. Contaminated fuel control/ fuel filter.	e. Clean or replace the filter. (Refer to para 5-12.)
10	Idle speed too low.	a. Incorrect gas producer lever setting.	a. Check lever position and rigging.
		b. Malfunctioning tachometer.	b. Replace tachometer. (Refer to TM 55-1520-228-23.)
		c. Excessive generator load.	c. Reduce electrical load requirement.
		d. Dirty compressor.	d. Clean compressor. (Refer to para 7-3.)
		e. Gas producer fuel control idle adjustment incorrectly set.	e. Adjust idle setting. (Refer to para 5-12.)
		f. Air sensing lines leaking.	f. Check for leaks. Tighten coupling nuts as required.
		g. Accumulator leaking.	g. Check for cracks in sheet metal or braze. Replace accumulator if leaks are found. (Refer to para 5-16.)
11	Idle speed too high.	a. Incorrect gas producer lever setting.	a. Check lever position and rigging.
		b. Malfunctioning tachometer.	b. Replace tachometer. (Refer to TM 55-1520-228-23.)
		c. Gas producer fuel control idle adjustment incorrectly set.	c. Correct the setting. (Refer to para. 5-12.)
		d. Contaminated fuel control.	d. Replace control. (Refer to para 5-12.)

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
12	Oil pressure drops off severely.	a. Oil supply low.	a. Check oil supply and refill as necessary.
		b. Oil pressure transmitter hose obstructed.	b. Clean or replace oil transmitter hose (refer to TM 55-1520-228-23).
		c. Regulator valve sticking or broken spring.	c. Clean valve or replace spring. (Refer to para 5-26.)
		d. Defective oil pump.	d. Replace engine. (Refer to TM 55-1520-228-23.)
		e. Oil pressure transmitter or indicator giving false indication.	e. Check transmitter or indicator and repair or replace if necessary. (Refer to TM 55-1520-228-23.)
13	Excessive oil pressure fluctuation.	a. Low oil supply.	a. Check oil supply and refill as necessary.
		b. Air in sensing line.	b. Bleed line.
		c. Faulty pressure regulating valve.	c. Replace the valve. (Refer to para 5-26.)
		d. Oil contamination foaming and foreign objects in tanks.	d. Drain oil, inspect oil tank for foreign objects and replace filter. (Refer to para 5-25.) Inspect magnetic chip detectors for metallic particles. (Refer to para 5-24.) Thoroughly flush with engine oil while motoring engine. Drain and refill with engine oil.
		e. Internally kinked or twisted engine oil inlet line.	e. Replace oil line. (Refer to TM 55-1520-228-23.)
14	Low oil pressure.	a. Low oil supply.	a. Check oil supply and refill as necessary.
		b. Oil leaks.	b. Check all piping and connections.
		c. Clogged oil filter.	c. Clean or replace oil filter. (Refer to para 5-25.)
		d. Oil pressure hose obstructed.	d. Clean or replace transmitter hose (refer to TM 55-1520-228-23).
		e. Gage records inaccurately.	e. Check gage and transmitter.
		f. Oil pressure not properly adjusted.	f. Adjust oil pressure regulating valve. (Refer to para 5-26.)
		g. Increase in oil pump internal clearances or sheared drive.	g. Replace engine. (Refer to TM 55-1520-228-23.)
		h. Oil contamination and foaming.	h. Drain oil and replace filter. (Refer to para 5-25.) Inspect magnetic chip detectors for metallic particles. (Refer to para 5-24.) Thoroughly fluch with engine oil while motoring engine. Drain and refill with engine oil.

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
15	High oil pressure.	a. Oil pressure gage and transmitter records inaccurately. b. Pressure regulating valve improperly adjusted.	a. Check gage and transmitter. b. Readjust oil pressure regulating valve. (Refer to para 5-26.)

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
16	**ENGINE OIL TEMPERATURE EXCEEDS 225° F (107° C) but remains less than 248° F (120° C) for a period not exceeding ten minutes WITHOUT ANY CHANGE IN NORMAL OIL PRESSURE.**	**Contaminated oil or oil cooler malfunction.**	a. Drain and refill engine oil system. b. Inspect the magnetic drain plugs. c. Inspect oil filter and clean or replace as required. d. Check for carbon deposits (coking). e. Ground run engine for ten minutes. Obtain as high a power level as possible without lift-off (without exceeding maximum continuous rating). f. Reinspect the magnetic drain plugs. If the magnetic drain plugs are free of particles, reinspect after five hours of operation. g. If carbon particles are found, repeat the maintenance procedure.
17	**IF ENGINE OIL TEMPERATURE EXCEEDS 225° F (107° C) but remains less than 248° F (120° C) for a period not exceeding 10 minutes WITH A CHANGE IN NORMAL OIL PRESSURE.**	**Contaminated oil or oil cooler malfunction.**	a. Do not attempt to adjust the oil pressure regulating valve setting, replace the oil filter housing assembly. (Refer to para 5-27.) b. Inspect and replace the oil filter. Check for carbon deposits (coking). c. Drain and refill engine oil system. d. Inspect magnetic drain plugs. e. Start engine and check oil pressure at 78.2% N1 speed or above; if pressure is not within 90 to 130 psig, adjust oil pressure regulator valve as required. f. If correct oil pressure is obtained, perform steps d and e under ENGINE OIL TEMPERATURE EXCEEDS 225° F (107° C) WITHOUT ANY CHANGE IN NORMAL OIL PRESSURE. g. If correct oil pressure cannot be obtained by regulator valve adjustment, replace engine. (Refer to TM 55-1520-228-23.)

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
18	OIL TEMPERATURE EXCEEDS 248° F (120° C) momentarily or 225° F (107° C) for a period exceeding 10 minutes.	Contaminated oil or oil cooler malfunction.	a. Remove the engine and send it to an overhaul facility for inspection or repair as required. b. Tag the engine indicating that maximum allowable operating oil temperatures were exceeded. Give maximum temperature and elapsed time.
19	No response to oil pressure adjustment.	Defective pressure regulating valve.	Replace oil filter housing assembly. (Refer to para 5-27.)
20	Oil consumption exceeds 0.05 gallon (0.19 litres or 6.5 oz) per hour.	a. External oil leaks.	a. Check all fittings and connections.
		b. Oil leakage from power turbine oil bellows seal.	b. Replace engine. (Refer to TM 55-1520-228-23.)
		c. Leaking accessory oil seals as evidenced by oil draining from weep hole (on gas producer fuel control and power turbine governor) or from drain on fuel pump.	c. Replace defective seals. (Refer to para 7-27.)
21	Oil spewing from diffuser vent orifice.	Orifice improperly sized.	Replace orifice with next smaller size.
22	Low power with high TOT.	a. Compressor foreign object damage or excessive erosion.	a. Replace engine if damage exceeds limits. (Refer to para 7-9 or 7-10.)
		b. Dirty compressor.	b. Clean compressor. (Refer to para 7-3.)
		c. Compressor bleed valve has failed to close.	c(1). Check compressor discharge pressure sensing line for leaks and for security. c(2) Clean valve nozzle, filter, strainer and jet. (Refer to para 7-7). c(3) Replace compressor bleed valve. (Refer to para 5-33).
		d. Excessive air leaks.	d. Repair leaks.
		e. Leaking aircraft heat control valve.	e. Replace valve.
		f. Faulty TOT indicator.	f. Replace indicator. (Refer to TM 55-1520-228-23.)
		g. Faulty torquemeter indicating system.	g. Bleed gage line. Replace defective gage. (Refer to TM 55-1520-228-23.)
		h. Anti-icing valve leaking.	h. Check linkage or replace valve. (Refer to para 5-32.)
		i. Leaking from deteriorated flexible portion of the aircraft heat tube assembly.	i. Replace tube assembly.
23	Low power with TOT below maximum limit.	a. Loose pneumatic tube fitting, cracked accumulator, or cracked pneumatic tube causing air leak in control system.	a. Pressurize the system to check for leaks. (Refer to para 5-8.)

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
23 (cont)		b. Gas producer control lever does not reach maximum speed adjustment stop.	b. Adjust linkage to the gas producer fuel control.
		c. Gas producer control lever maximum speed adjustment stop not properly set.	c. Correct tne maximum speed adjustment setting. Adjust cw to increase N1 speed—one turn equals (approx) 1%. (Refer to para 5-12.)
		d. Gas producer control calibration shifted.	d. Replace control. (Refer to para 5-12.)
24	Low measured TOT at normal or high power.	a. Faulty TOT indicator.	a. Replace indicator. (Refer to TM 55-1520-228-23.)
		b. Loose thermocouple wire terminal.	b. Tighten terminal.
		c. Faulty TOT thermocouple asassembly.	c. Replace engine. (Refer to TM 55-1520-228-23.)
25	Engine N1 overspeed above maximum limits.	a. Faulty N1 tachometer, or indicator.	a. Replace tachometer generator or indicator. (Refer to TM 55-1520-228-23.)
		b. Faulty gas producer fuel control.	b. Replace fuel control. (Refer to para 5-12.)
26	Engine N2 overspeeds.	a. Gas producer fuel control or power turbine governor linkage not properly set.	a. Check linkage for proper operation and adjustment. (Refer to para 5-12 and 5-13.)

NOTE

During ground run after overspeed incident, note the idle speed with the twist grip at 30 degree position. If idle speed is normal, suspect the governor—if idle speed is high, suspect the gas producer fuel control as the faulty component.

Item	Trouble	Probable cause	Remedy
		b. Defective gas producer fuel control or power turbine governor.	b. Replace defective control or governor. (Refer to para 5-12 or 5-13.)
		c. Faulty N2 tachometer, or indicator.	c. Replace tachometer generator or indicator. (Refer to TM 55-1520-228-23.)
27	Excessive exhaust torching during start and transients.	a. Fuel nozzle malfunction.	a. Replace fuel nozzle. (Refer to para 5-15.)
		b. Excessively rich gas producer fuel control.	b. Replace control. (Refer to para 5-12.)
		c. Leaking accessory bleed lines.	c. Repair or replace lines.
28	Slow to accelerate from idle to power.	a. Dirty compressor.	a. Clean compressor. (Refer to para 7-3.)
		b. Loose pneumatic fittings.	b. Tighten or replace as required.
		c. Excessive generator load.	c. Reduce electrical load.
		d. Excessive compressor air leakage.	d. Check for leaks and repair.

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
28 (cont)		e. Gas producer control acceleration schedule too lean.	e. Replace control. (Refer to para 5-12.)
29	Slow to accelerate to power while in flight.	a. Same as in preceding Trouble.	a. Correct as in preceding Trouble.
		b. Governor linkage incorrectly rigged.	b. Check rigging. Correct linkage as required. (Refer to para 5-13.)
30	TOT approximately 30° C lower than normal at idle.	Bleed control valve stuck closed.	Replace bleed control valve. (Refer to para 5-33.)
31	Engine power reset to the takeoff setting.	Aircraft gas producer linkage broken or disengaged.	Replace linkage or reconnect.
32	Compressor stall during starting or near idle speed. (Refer to TM 55-1520-228-10 for stall definition.)	a. Dirty compressor.	a. Clean compressor. (Refer to para 7-3.)
		b. Bleed control valve stuck closed.	b. Replace bleed control valve. (Refer to para 5-33.)
		c. Excessively rich gas producer fuel control.	c. Replace gas producer fuel control. (Refer to para 5-12.)
33	Compressor stall during acceleration.	a. Bleed control valve has failed to open.	a. Replace bleed control valve. (Refer to para 5-33.)
		b. Excessively rich gas producer fuel control.	b. Replace gas producer fuel control. (Refer to para 5-12.)
		c. Compressor erosion.	c. Inspect compressor. Correct as required.
34	Compressor stall during low power operation.	Bleed control valve has failed to open.	Replace bleed control valve. (Refer to para 5-33.)
35	Excessive fuel leaking from drains or weep holes.	a. Fuel pump drive shaft seal diaphragm ruptured or leaking.	a. Replace fuel pump. (Refer to para 5-9.)
		b. Gas producer fuel control failure.	b. Replace fuel control. (Refer to para 5-12.)
36	Faulty torquemeter indication.	a. Faulty torque indicating system.	a(1). Bleed air from line to gage. a(2). Replace gage (Refer to TM 55-1520-228-23.) a(3). Clean or replace obstructed line to gage (refer to TM 55-1520-228-230).
		b. Faulty engine torquemeter.	b. Replace engine. (Refer to TM 55-1520-228-23.)
37	Lack of anti-icing air.	a. Improper rigging.	a. Check rigging.
		b. Defective anti-icing air lines.	b. Check lines.
		c. Anti-icing air valve stuck closed.	c. Replace valve. (Refer to para 5-32.)
		d. Dirt collected in vane trailing slot.	d. Remove anti-icing air lines at the compressor front support and blow through struts and out slots.

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
38	**Continuous exhaust smoking.**	**a. Compressor front bearing oil seal leaking.**	a. Replace engine if oil consumption exceeds limit. (Refer to TM 55-1520-228-23.)
		b. Power turbine oil bellows seal leaking.	b. Replace engine.
		c. Internal turbine seals leaking.	c. Replace engine if oil consumption exceeds limit. (Refer to TM 55-1520-228-23.)
39	**Compressor rear bearing labyrinth seal vent smoking.**	**Seal vent orifice improperly seated.**	Replace vent orifice. (Refer to para 10-9.)
40	**Exhaust smoking on shutdown or engine start.**	**a. Turbine rear bearing sump and nut assembly leaking.**	a. Replace engine if oil consumption exceeds limit. (Refer to TM 55-1520-228-23.)
		b. Faulty external oil check valve.	b. Clean valve (Refer to para 5-29.)
41	**Static oil leakage from burner drain valve.** on shutdown.)	**a. Faulty airframe check valve.**	**a. Replace valve. (Refer to TM 55-1520-228-23.)**
		b. Oil leakage from turbine or combustion section.	b(1). Remove and inspect the external check valve. (Refer to para 5-29.) b(2). Inspect for leakage from power turbine carbon face seal.
42	Deleted		
43	Deleted		

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
44	Deleted		
45	Afterfire.	a. Oil leak.	a. See item 47.
		b. Burner drain valve line obstruction.	b. Check the drain lines. Clean or replace as necessary.
		c. Sticking burner drain valve.	**c. Replace valve. (Refer to para 5-38.)**
		d. Fuel nozzle valve stuck open.	**d. Replace fuel nozzle. (Refer to para 5-15.)**
		e. Gas producer fuel control cutoff valve not fully closed.	e. Check linkage or replace fuel control. (Refer to para 5-12.)
46	High temperature during shutdown.	Fuel control shutoff valve not closed.	Check linkage to fuel control. Verify that twist grip was in the closed position.
47	Oil leakage during shutdown periods (smoking on shutdown.)	a. Oil leakage from compressor forward bearing seal.	a. Replace engine. (Refer to TM 55-1520-228-23.)
		b. Oil leakage from turbine or combustion section.	b(1). Remove and inspect the external check valve. (Refer to para 5-29.) b(2). Inspect for leakage from power turbine carbon face seal.
48	Static oil leakage from power and accessory gearbox breather.	a. Internal check valve stuck.	a(1). Clean or replace the internal check valve. (Refer to para 5-28.) **a(2). Remove filter housing and inspect housing and transfer tubes (2) mating surfaces. Check preformed packing on housing end of transfer tubes. Replace defective items. (Refer to para 5-27.)**
49	Oil leaking from weep holes at gas producer fuel control and/or power turbine fuel governor.	Check engine oil seal.	Replace leaking seal. (Refer to para 7-27.)
50	Starter unable to rotate engine immediately after shutdown.	Turbine blade tip clearance.	If engine will rotate after cooldown, no corrective action required. If unable to rotate engine after cooldown, replace engine. (Refer to TM 55-1520-228-23.)

Table 4-1. Troubleshooting (Continued)

ITEM	TROUBLE	PROBABLE CAUSE	REMEDY
51	Main rotor does not rotate by 30% N1	a. Dirt or sand between fourth stage turbine wheel and shroud.	a. Blow out with compressed air.
		b. Turbine blade tip (N2) rub.	b. Shut down. Repeat start procedure. If not rotating after third attempt, replace engine. (Refer to TM 55-1520-228-23.)
		c. Carbon formation around rotating labyrinth seals.	c. Shut down. Ensure that the oil being used is MIL-L-7808F or G, or MIL-L-23699. Repeat start procedure. If not rotating after third attempt, replace engine. (Refer to TM 55-1520-228-23.)
52	Unable to obtain maximum N2 rpm.	a. Air leak in control air tubes.	a. Tighten tube fittings.
		b. Improper control rigging.	b. Check rigging.
		c. Faulty power turbine governor.	c. Replace governor. (Refer to para 5-13.)
53	Engine tubing cracked or broken at the flare.	Excessive vibration.	Check the engine for possible vibration causes. (Refer to the vibration inspections in para 12-8.)
54	Power turbine governor and gas producer fuel control throttle shaft binding.	Corrosion buildup on shaft causing a tight fit in the throttle shaft bushing.	Apply (Item 36, Table 2-2) to the area shown in figure 4-3 and figure 4-4; a one second spray should be sufficient. Rotate shaft, back and forth, following spray to assure penetration. Repeat spray if necessary.
55	Power loss, N2 droop or flameout.	a. Improper rigging.	Refer to para 4-3.
		b. Cracks, scratches, and dents.	
		c. Improper sealing or sealing surfaces.	

Table 4-1. Troubleshooting (Continued)

ITEM	TROUBLE	PROBABLE CAUSE	REMEDY
56	Health Indicator Test (HIT)	a. Dirty compressor	a. Clean compressor. (Refer to Chapter 7.)
		b. Air leaks.	b. Check air tubing, connector, and heater hose. Make repairs as necessary.
		c. FAT (Thermometer)	c. Replace thermometer if necessary. (Refer to TM 55-1520-228-23.)
		d. TOT Indicator and System	d. Make repairs, adjustments, or replacements as necessary. (Refer to TM 55-1520-228-23.)
		e. N1, Tachometer and Generator	e. Make repairs, adjustments, or replacements as necessary. (Refer to TM 55-1520-228-23.)

4-2. Health Indicator Test (HIT).

NOTE

New baseline values for HIT will be established when the engine, power turbine governor, fuel control, compressor case halves or FAT have been replaced or when the reverse flow air inlet fairings have been removed or installed.

NOTE

When it is necessary to establish new baseline values for HIT, it is recommended that HIT baselines be established, in sequence, for both configurations of reverse flow fairings removed. Install both HIT logs in the aircraft logbook. The pilot will use whichever HIT log is applicable at the time.

a. The HIT is the method by which the aviator in day-to-day flying monitors the aircraft engine condition. This is accomplished by the aviator selecting an N1 Speed (%) predicted upon the existing OAT. The TOT must then relate to a predicted value (Baseline TOT) within a certain tolerance. TOT variation from baseline values are logged by the aviator. (Refer to TM 55-1520-235-10.) This log, part of the engine records, is available to the maintenance officer as an aid in monitoring performance trends and in troubleshootoing. When the difference between a recorded TOT and the baseline TOT is ± 20°C to 39°C, the aviator will make an entry on DA Form 2408-13 to notify the Maintenance Officer. A difference of ± 40°C or greater is cause for grounding the aircraft until troubleshooting determines the cause.

b. Establish the HIT Baseline TOT Values as follows:

NOTE

Prior to establishing new HIT baseline, clean compressor and test accuracy of the following instruments and systems: TOT, FAT, N1 Tachometer. (Refer to item 56, Table 4-1.)

(1) Perform normal engine runup and cockpit procedures in accordance with the applicable -10 manual.

NOTE

The HIT baseline TOT date should not be established until completion of all other pretakeoff procedures. This assures that the engine is completely warm and the instruments stabilized.

(2) Maintain N2 at 100%.

(3) Turn off all bleed air. Turn generator off.

(4) Turn aircraft into the wind and read free air temperature on cockpit OAT gage.

(5) Utilizing a blank HIT Baseline TOT Work Sheet (figure 4-1) locate OAT in first column, nearest the free air temperature read on the cockpit OAT gage. Circle this OAT.

(6) Set N1 % at the value indicated in column 2 opposite this OAT. Allow TOT to stabilize.

(7) Read TOT from indicator. Record TOT beside the circled OAT.

(8) Apply the Δ TOT A Correction Factor in column 3 adjacent to the circled OAT to indicated TOT and record the result in the open space in column 4.

(9) Apply Δ TOT B Correction Factor in column 5 to the TOT in column 4. Record results for each of the OAT/N1 combinations shown in column 8.

(10) Enter baseline information in the respective columns of the HIT TOT Log (see figure 4-2.)

(11) The HIT TOT Log should be placed in the log book where aviators can utilize it in accordance with applicable -10 manual direction. The HIT TOT Work Sheet should be retained with the engine Historical Records and discarded only after the compleiton of the second successive HIT Baseline. The Current HIT LOG Work Sheet should accompany the Historical Records when the engine is removed for any reason.

HIT TOT WORKSHEET

Instructions to Maintenance Officer:

1. Maintain N2 at 100% and stabilize all instruments.
2. Turn off all bleed air.
3. Turn generator off.
4. With rotor turning, read free air temperature from cockpit OAT indicator.
5. Enter line 1 at OAT nearest free air temperature.
6. Set N1% at value indicated in line 2.
7. Read TOT from indicator.
8. Apply ΔTOT_A Correction Factor in line 3 to indicated TOT and record result in box in center of line 4.
9. Apply each of the ΔTOT_B Correction Factors in line 5 to the corrected TOT in line 4 and record the result in each of the blank spaces in line 6.
10. Enter Baseline information in the respective columns of the Engine HIT log.
11. Enter aircraft or engine hours and word "Baseline" in log section at bottom of Engine HIT Log.

Aircraft S/N ____________________

Engine S/N ____________________

Aircraft Hrs ____________________

Engine Hrs ____________________

1	OAT °C	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	-14	12	10	8	-6	-4	-2	
2	N1%	73.9	74.2	74.6	74.9	75.2	75.6	75.9	76.2	76.5	76.8	77.2	77.5	77.8	78.1	78.4	78.7	79.0	79.4	79.7	80.0	80.3	80.6	80.9	81.2	81.5	
3	ΔTOT_A	+188	+182	+176	+171	+165	+159	+153	+148	+142	+136	+130	+124	+119	+113	+107	+101	+95	+90	+84	+78	+72	+67	+61	+55	+49	
4	$\frac{TOT}{0}$	– (Record Corrected TOT here) →																									
5	ΔTOT_B	188	182	176	171	165	159	153	148	142	136	130	124	119	113	107	101	95	90	84	78	72	67	61	55	49	
6	Base-line TOT																										

1	OAT °C	0	2	4	6	8	10	12	14	15	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
2	N1%	81.8	82.1	82.4	82.7	83.0	83.3	83.6	83.9	84.0	84.1	84.4	84.7	85.0	85.3	85.6	85.9	86.2	86.4	86.7	87.0	87.3	87.6	87.8	88.1	88.4	88.7	89.0
3	ΔTOT_A	+43	+38	+32	+26	+20	+15	+9	+3	+0	-3	-9	-15	-20	-26	-32	-38	-43	-49	-55	-61	-67	-72	-78	-84	-90	-95	-101
4	$\frac{TOT}{0}$																											
5	ΔTOT_B	43	38	32	26	20	-15	-9	-3	+0	+3	+9	+15	+20	+26	+32	+38	+43	+49	+55	+61	+67	+72	+78	+84	+90	+95	+101
6	Base-line TOT																											

Figure 4-1. OH-58C HIT TOT Work Sheet.

Aircraft S/N

OH-58C HIT TOT LOG

Engine S/N

OAT °C	-50	-48	-46	-44	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18
N1%	73.9	74.2	74.6	74.9	75.2	75.6	75.9	76.2	76.5	76.8	77.2	77.5	77.8	78.1	78.4	78.7	79.0
Baseline TOT																	

OAT °C	-16	-14	-12	-10	-8	-6	-4	-2	0	2	4	6	8	10	12	14	16
N1%	79.4	79.7	80.0	80.3	80.6	80.9	81.2	81.5	81.8	82.1	82.4	82.7	83.0	83.3	83.6	83.9	84.1
Baseline TOT																	

OAT °C	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50		
N1%	84.4	84.7	85.0	85.3	85.6	85.9	86.2	86.4	86.7	87.0	87.3	87.6	87.8	88.1	88.4	88.7	89.0		
Baseline TOT																			

Instructions:

1. Maintain N2 at 100% and stabilize all instruments.
2. Face aircraft into wind and turn off all bleed air.
3. Turn generator off.
4. With rotor turning, read free air temperature from cockpit OAT indicator.
5. Enter OAT line at value nearest to free air temperature read on OAT indicator.
6. Set N1 at valve indicated in N1% line. Allow TOT to stabilize.
7. Read TOT from indicator.
8. Compare TOT with value recorded in line labeled Baseline TOT and N1% utilized.
9. Record aircraft or engine hours and difference (±) between indicated TOT and Baseline TOT in log section below.
10. If difference between indicated TOT and Baseline TOT is: A. ± 20°C or greater - enter on DA Form 2408-13.

    B. ± 40°C or greater - Aircraft should not be flown until cause for excessive TOT is determined. Enter on DA 2408-13.

Acft or Eng Hrs (-13)	Difference from Baseline TOT(±)	Acft or Eng Hrs (-13)	Difference from Baseline TOT(±)	Acft or Eng Hrs (-13)	Difference from Baseline TOT(±)	Acft or Eng Hrs (-13)	Difference from Baseline TOT(±)	Acft or Eng Hrs (-13)	Difference from Baseline TOT(±)

Figure 4-2. OH-58C HIT TOT Log

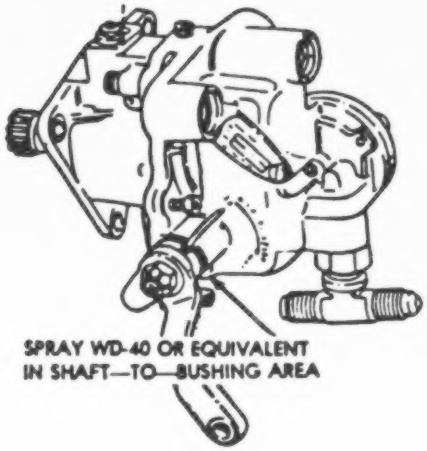

SPRAY WD-40 OR EQUIVALENT
IN SHAFT—TO—BUSHING AREA

Figure 4-3. Bendix Governor

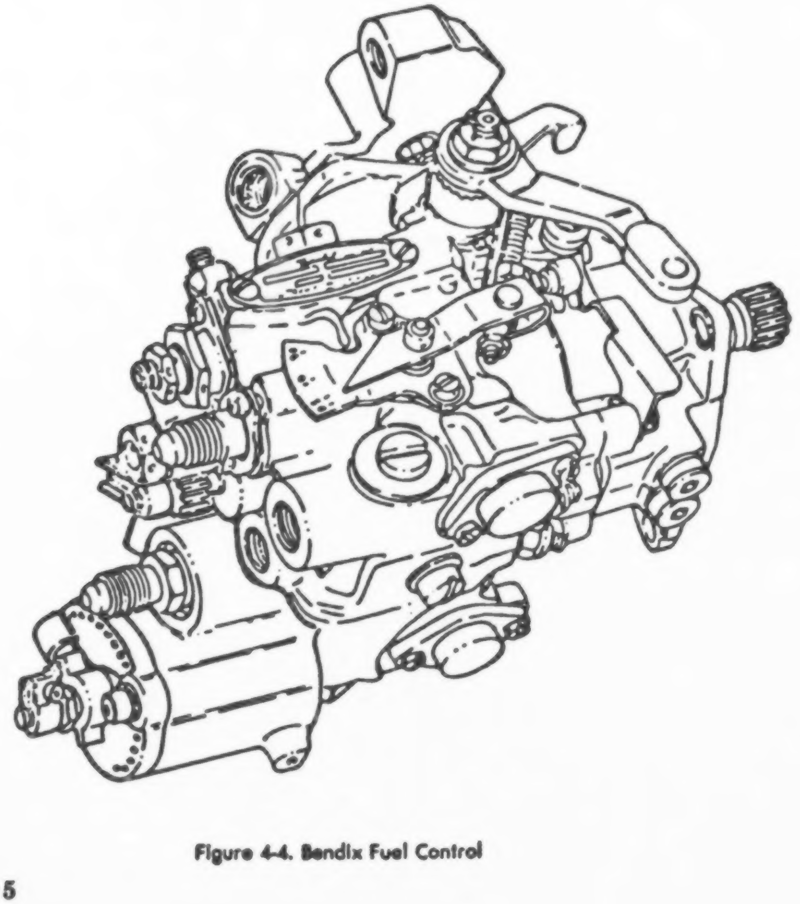


Figure 4-4. Bendix Fuel Control

4-3. Power Loss, N2 Droop or Flamout Parameter Maintenance Check Procedures.

Check maintenance procedures for OH-58 aircraft when a power loss, N2 droop, or flameout occurs. N2 droop may occur during a normal flight maneuver requiring a rapid increase in power (i.e., rapid collective and or tail rotor inputs, high G turn, steep turn). If N2 droop occurs, but low RPM warning is not activated and N2 recovers to 100 percent on OH-58C, and further N2 droop is not experienced, no maintenance action is required.

NOTE

For all maintenance actions notes below, pnuematic line fittings are to be torqued to specified values utilizing a torque wrench. All lines are to be installed so that there is no preload or deformation of the line in accordance with applicable TM's.

a. When a power loss, N2 droop, or flameout occurs (in parameters other than those established in paragraph above), check/inspect to determine the reason/reasons in accordance with the troubleshooting charts in table 4-1.

b. If a reason/reasons for power degradation cannot be established using the procedures specified in paragraph above, request assistance from AVIM Maintenance and proceed with the maintenance actions noted in paragraphs (1) through (5) below. If this is a second occurrence of power degradation on this aircraft/engine and the maintenance actions listed below have been complied within the last 100 flying hours, replace the engine.

(1) Check engine controls for proper rigging. Check throttle angle on fuel control at idle detent for the pilot's and co-pilot's twist grip. Maximum allowable variation between the pilot's and co-pilot's twist grip is 5/64-inch as measured on the fuel control sector. Re-rig controls if not within specifications per TM 55-1520-228-23 and per this TM for OH-58C aircraft.

(2) Remove engine fuel and pneumatic lines. Replace engine fuel filter P/N 6895177, NSN 2910-01-040-2607 on OH-58C aircraft. Inspect fittings and lines for cracks, scratches dents and improper seating on sealing surfaces. Inspect lines and fittings for contamination. Clean all lines per applicable TM's. Inspect lines for chafing, check compressor bleed valve. Correct any discrepancies. Inspect and clean PC filter P/N 687458, NSN 2945-00-231-8065 (OH-58C only). On OH-58C replace fuel nozzle P/N 6890917, NSN 2915-01-039-4730 and check valve P/N 6895171, NSN 4820-01-045-0205. Reinstall pneumatic lines and filter. Leak check pneumatic system in accordance with TM 55-2840-241-23. Check compressor bleed valve for proper operation.

(3) Remove all hoses, fittings and valves including fuel shutoff valve from the fuel boost pump to the engine. Clean and inspect all for damage and restrictions. Reinstall or replace as applicable. Bleed the fuel system in accordance with the appropriate TM. With aircraft fuel shutoff valve open, start boost pump and check all accessible fuel lines, connections, and fittings outside the fuel cell for leakage. Inspect and lubricate starter generator splines. Check calibration of dual tachometer (N2 and rotor RPM).

(4) Check main and tail rotor systems for proper rigging and pitch angle, and re-rig as necessary.

(5) Start engine and perform deceleration check. If deceleration check is not in limits, replace fuel control P/N 6895672, NSN 2915-01-034-4671; N2 governor P/N 6895673, NSN 2915-01-034-4317 and double check valve P/N 6876557, NSN 4820-01-047-2796 on OH-58C aircraft. Repeat deceleration check, if satisfactory, perform test flight in accordance with established procedures.

c. Aircraft are restricted from NOE contour, low level, and night flight for 10 hours after completion of the preceding procedures and must be flown at an altitude to allow safe autorotation as defined in TM 55-1520-228-10 or TM 55-1520-235-10 charts. After completion of the 10-hour restriction, repeat deceleration check. If satisfactory, perform test flight in accordance with established procedures. No further flight restrictions are imposed.

d. After completion of power loss, N2 droop, or flame out parameter maintenance check procedures, make an entry on engine DA Form 2408-15 citing date the inspection was performed and engine hours at the time inspection was performed.

4-4. Engine Performance Check. See applicable aircraft Maintenance Test Flight Manual (MTF).

CHAPTER 5

ACCESSORIES SERVICING

Section I. GENERAL

5-1. Scope.

This section is intended to be used by Aviation Unit and Aviation Intermediate Maintenance personnel to perform accessories maintenance with maximum efficiency. Maintenance functions are grouped into sections by systems. Each section includes detailed instructions for removal, installation, adjustment, lubrication, and minor servicing of the individual components of the system.

5-2. General Practices and Precautions.

When performing maintenance on the engine, the following practices and precautions must be observed.

WARNING

Prolonged contact with lubricating oil, (item 7, table 2-2) may cause a skin rash. Those areas of skin and clothing that come in contact with lubricating oil should be thoroughly washed immediately. Areas in which lubricating oil is used should be adequately ventilaged to keep mist and fumes to a minimum.

NOTE

Lubricating oil may soften paint upon contact. If lubricating oil is spilled on painted surfaces, these surfaces should be thoroughly washed.

a. Protect engine from dust and inclement weather. When possible, perform maintenance in a sheltered area.

b. On removal of engine components, exercise care to prevent dirt and other foreign matter from entering the engine. Caps, plugs, or temporary covers shall be used to close all openings. Do not use tape to cover fuel and oil openings. Tape adhesive is soluble in fuel or oil and can cause contamination.

c. When the gas producer fuel control, power turbine governor, check valve, or accumulator are removed from the engine, use extreme care to prevent foreign materials from entering the pneumatic lines or the ports of the component.

d. Always use a backup wrench on fittings when removing or installing tubing.

e. Before removing ignition components, disconnect the input power lead at the ignition exciter.

f. Carefully inspect the condition of all replacement parts before installation.

g. Never attempt to rotate the gear trains and rotors using a speed wrench at the tachometer drive pads. Side loads on the speed wrench could crack the tachometer drive shaft. Rotate the gas producer gear train and rotor using the 6799790 turning adapter at the fuel control, fuel pump, starter-generator, or spare accessory drive pad. Rotate the power turbine gear train and rotor using the 6799790 turning adapter at the power turbine governor drive pad.

5-3. Hardware.

Use 0.020 in. diameter stainless steel lockwire (item 10, table 2-2) where lockwire size is not specified. Double strand lockwire all drilled bolts, plugs, and screws, except those locked with self-locking nuts or lockwashers. Lockwire bolts in pairs where possible. When reassembling, be sure to safety wherever lockwire was removed.

CAUTION

To prevent possible failure, Do not use zinc lockwire. Do not reuse lockwire, cotter pins, ring seals, lip seals, composition gaskets, and split or tab washers.

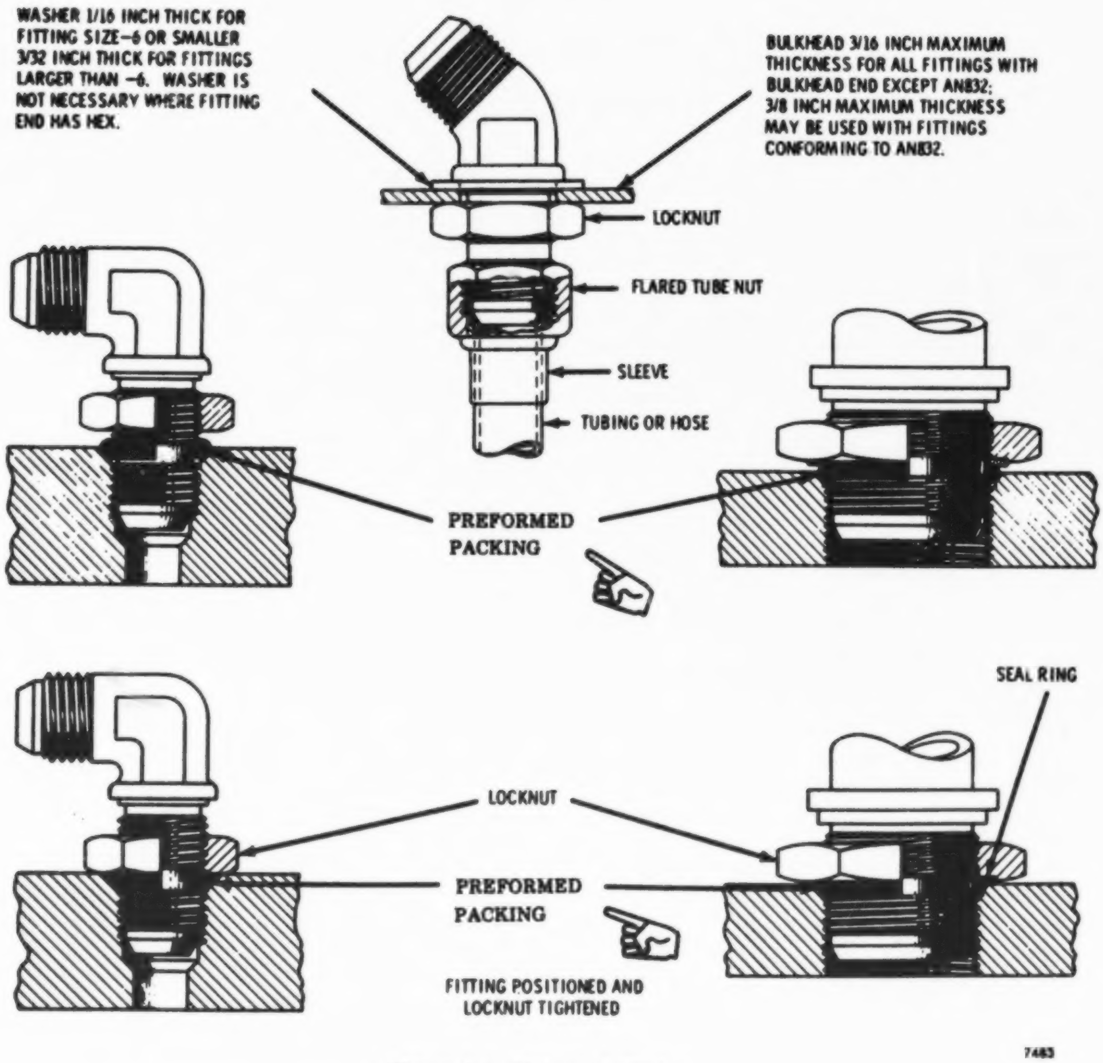

WASHER 1/16 INCH THICK FOR FITTING SIZE—6 OR SMALLER 3/32 INCH THICK FOR FITTINGS LARGER THAN —6. WASHER IS NOT NECESSARY WHERE FITTING END HAS HEX.
BULKHEAD 3/16 INCH MAXIMUM THICKNESS FOR ALL FITTINGS WITH BULKHEAD END EXCEPT AN832; 3/8 INCH MAXIMUM THICKNESS MAY BE USED WITH FITTINGS CONFORMING TO AN832.
LOCKNUT
FLARED TUBE NUT
SLEEVE
TUBING OR HOSE
PREFORMED PACKING
SEAL RING
LOCKNUT
PREFORMED PACKING
FITTING POSITIONED AND LOCKNUT TIGHTENED
7483

Figure 5-1. Universal Fittings

5-4. Universal Fittings.

a. Use this procedure to install universal fittings with backup rings. (see figure 5-1).

(1) Install the nut on the fitting and run it back until the counterbore of the nut aligns with the upper inner corner of the seal groove.

(2) Lubricate seals used on oil, anti-icing, and bleed air tube fittings with lubricating oil (item 7, table 2-2). Lubricate seals used on fuel tube fittings with lubricating oil (item 8, table 2-2). DO NOT lubricate seals used on fuel system control air tube fittings. Install the seal on the fitting.

(3) Work the backup ring into the counterbore of the nut.

(4) Turn the nut down until the seal is pushed firmly against the lower threaded section of the fitting.

(5) Install the fitting into the boss, making certain the nut turns with the fitting, until the seal touchers the boss. Then tighten the fitting one and one-half turns more.

(6) Put a wrench on the nut to prevent its turning, and position the fitting by turning it not more than one turn.

(7) Hold the fitting in its position and tighten the nut against the boss.

b. Use this procedure to install universal fittings without backup rings. (See figure 5-1.)

(1) Run the nut on the fitting end back until the washer face is aligned with the upper inner corner of the seal groove.

(2) Lubricate seals used on oil, anti-icing, and bleed air tube fittings with lubricating oil (item 7, table 2-2). Lubricate seals used on fuel tube fittings with lubricating oil (item 8, table 2-2). DO NOT lubricate seals used on fuel system control air tube fittings. Place the seal in the seal groove.

(3) Screw the fitting into the boss until the seal barely touches the boss.

(4) Turn the fitting and nut together until the nut touches the boss.

(5) Put a wrench on the nut to prevent its turning, and position the fitting by turning it in up to 270° or unscrewing it up to 90° .

(6) Hold the fitting in its proper position and tighten the nut against the boss.

5-5. Rigid Tube Installation.

a. Tube assemblies must fit and be aligned with the mating flare tube fittings to the degree that at both ends of the assembly the flares shall uniformly seat in a free state on the cones of the mating fittings. The fit shall be without distortion or stretching of the tube assembly and to the degree that the nuts can be fully engaged up to the final one-half turn with light finger pressure.

b. In the event a tube does not align with the mating fittings, reposition the mating fittings to the degree that proper alignment may be attained. Final tightening of these fittings must be accomplished before the tube assembly is connected.

c. If proper alignment cannot be attained by repositioning mating flare tube fittings, bend the tube sufficiently to provide alignment in the free state as specified. Accomplish all bending with the tube removed from the engine. Adjustment of the fit may be accomplished by bending by hand at principal bends. In the event the tube cannot be bent by hand, the tube must be clamped in a fixture or device which will not scratch, indent, crimp, or mark the surface of the tube during the bending operation. The flattened effect of the cross section of the tube as a result of the reforming operation must not exceed 15 percent of the tube OD.

d. When proper free-state alignment is attained complete the tubing installation by simultaneously securing the coupling nuts and tightening them to proper torque. Always use a backup wrench on the tube fittings when tightening the tube coupling nuts.

e. When a component to which rigid tube assemblies are attached is replaced, remove all interfering tube assemblies to permit easy removal and reinstallation of the component. This precaution will prevent subsequent damage to the tube assemblies.

Section II. FUEL SYSTEM

5-6. General.

Fuel system servicing includes removal and installation of the fuel pump, gas producer fuel control, power turbine governor, fuel nozzle, and double check valve. In addition, it includes fuel filter replacement, cleaning the fuel nozzle, and adjusting the gas producer fuel control.

5-7. Bleeding the Fuel System.

Maintenance of the fuel system can result in air entrapment in the fuel lines and subsequent false starts. Following maintenance, purge the air from the fuel system as follows:

a. Disconnect the input lead to the ignition exciter.

b. Disconnect the fuel hose at the fuel nozzle; place the open end of the hose in a bucket.

c. Move the twist grip to the IDLE detent and motor the engine until a solid stream of fuel flows from the disconnected hose. (Use APU if available.)

d. Reconnect the fuel hose to the fuel nozzle and input lead to the ignition exciter or reset the IGN ENG circuit breaker.

5-8. Fuel System Pneumatic Leak Check.

If any fuel system control air tubing is removed or disturbed during maintenance, check the control air tubing for leaks as follows:

a. Disconnect the pressuring sensing (Pc) line from the pressure probe elbow in the diffuser scroll.

b. Apply 50-80 psi filtered air or nitrogen to the Pc line. Air will immediately escape from the pressure regulating air valve port on the power turbine governor.

c. Use a liquid soap solution (item 1, table 2-2) to check the air tubes for leakage. No leakage is acceptable. Clean the soap and water solution from the engine after the check is completed.

5-9. Fuel Pump.

a. Removal.

(1) Disconnect the before-filter and after-filter pressure lines (25 and 27, figure 5-2) and the seal drain line (26) from the fuel pump (24).

(2) Disconnect the fuel supply hose at pump inlet (23).

(3) Remove fuel tubes (3 and 4) between the fuel pump and control. It will not be necessary to disturb the clamping arrangement between the tubes.

(4) Remove the three self-locking nuts (29, figure 5-3) and washers (30) which secure the fuel pump (31) to the gearbox. Remove the pump from the mounting studs.

(5) Remove and discard mounting flange gasket (32) and performed packing (33).

(6) If a new pump is to be installed, remove the tube fittings and keep them for installation in the new pump. Discard preformed packing.

b. Installation.

(1) If a new pump is to be installed, transfer the tube fittings from the removed pump to the new pump. Use the preformed packing lubricated with oil (item 8, table 2-2). Tighten fittings in the inlet, discharge and bypass ports to 75-100 in. lb. Tighten fittings in the before-filter, after-filter, and seal drain ports to 55-80 in. lb.

(2) Lubricate new preformed packing (33, figure 5-3) with oil (item 7 or 8), table 2-2 and install on the pump drive.

(3) Coat fuel pump drive splines with lubricating oil (item 7, table 2-2).

(4) Install the pump with new gasket (32) on the mounting pad studs.

(5) Secure the pump with three washers (30) and self-locking nuts (29). Tighten the nuts to 70-85 in. lb.

(6) Install fuel tubes (3 and 4, figure 5-2) between the fuel pump and control. Tighten the tube coupling nuts to 150-200 in. lb.

(7) Connect the fuel supply hose at the pump inlet (23). Tighten coupling nut to 150-200 in. lb.

(8) Connect the before-filter, after-filter, and seal drain (25, 26, and 27) hoses. Tighten coupling nuts to 80-120 in. lb.

NOTE

On the first start after the fuel pump has been changed, return the gas producer lever to fuel cutoff and motor the engine for about 10 seconds if a false start occurs or if a start is not completed within 45 seconds.

c. Testing. Following installation of the fuel pump, test the engine as outlined in Chapter 10.

5-10. Fuel Filter.

WARNING

The fuel/air discharge is irritating and highly flammable. Mechanics must take suitable measures to protect their eyes and prevent fire.

The fuel filter is a 5-micron nominal, 15 micron absolute, paper element located inside the fuel pump. It is retained by a flanged cover on the rear of the pump. Replace the element as follows:

CAUTION

When there is evidence that fuel filter bypassing has occured, the fuel filter in the gas produced fuel control must also be cleaned or replaced. Contamination will be evident due to the fuel pump filter being by-passed. (Refer to para 5-12j.)

a. Place a container under the pump assembly as some fuel spillage is likely. Remove the two screws (8, figure 5-4) and washers (7) retaining the cover (5) to the housing.

b. Remove the cover and the element (3). Discard two preformed packing (2, 4) and the contaminated filter element. If the element is a tight fit, remove by pulling straight out. Twisting may cause the element end cap to tear off.

c. Clean the filter cover with a spray of solvent (item 3, table 2-2) or with a fuel-soaked cloth.

d. Be sure the element preformed packing (2) is in place then install the element (3) in the housing. Install the cover with new preformed packing. Tighten cover screws (8) to 95-105 in. lb.

NOTE

Lockwire is not required if filter cover screws are retained by self locking inserts.

e. **Purge as follows:**

WARNING

The fuel/air discharge is irritating and highly flammable. Mechanics must take suitable measures to protect their eyes and prevent fire.

(1) Remove the safety wire from the upper bleed port plug (b, Figure. 5-4, item 6.)

(2) Provide a shop rag to deflect the fuel spray.

(3) Turn on the aircraft boost pump.

(4) Loosen the upper drain port plug (6) (approximately ½ turn) until a solid stream of fuel is emitted and then retighten to 35-45 in. lbs.

(5) Turn off the aircraft boost pump.

(6) Remove any fuel that may have been spilled in the engine compartment and re-safety the upper bleed port.

5-11. Pc Filter.

a. Removal.

(1) Disconnect air tubes (22, 78, figure 5-3) from both ends of filter (69). Hold the filter while loosening the coupling nuts.

(2) Remove nut (64) and bolt (63) securing filter clamp (65) to filter mounting bracket. Remove the filter and separate the clamp from the filter.

e. **Purge as follows:**

WARNING

The fuel/air discharge is irritating and highly flammable. Mechanics must take suitable measures to protect their eyes and prevent fire.

(1) Remove the safety wire from the upper bleed port plug (b, Figure 6-4).

(2) Provide a shop rag to deflect the fuel spray.

(3) Turn on the aircraft boost pump.

(4) Loosen the upper drain port plug (6) (approximately ½ turn) until a solid stream of fuel is emitted and then retighten to 35-45 in. lbs.

(5) Turn off the aircraft boost pump.

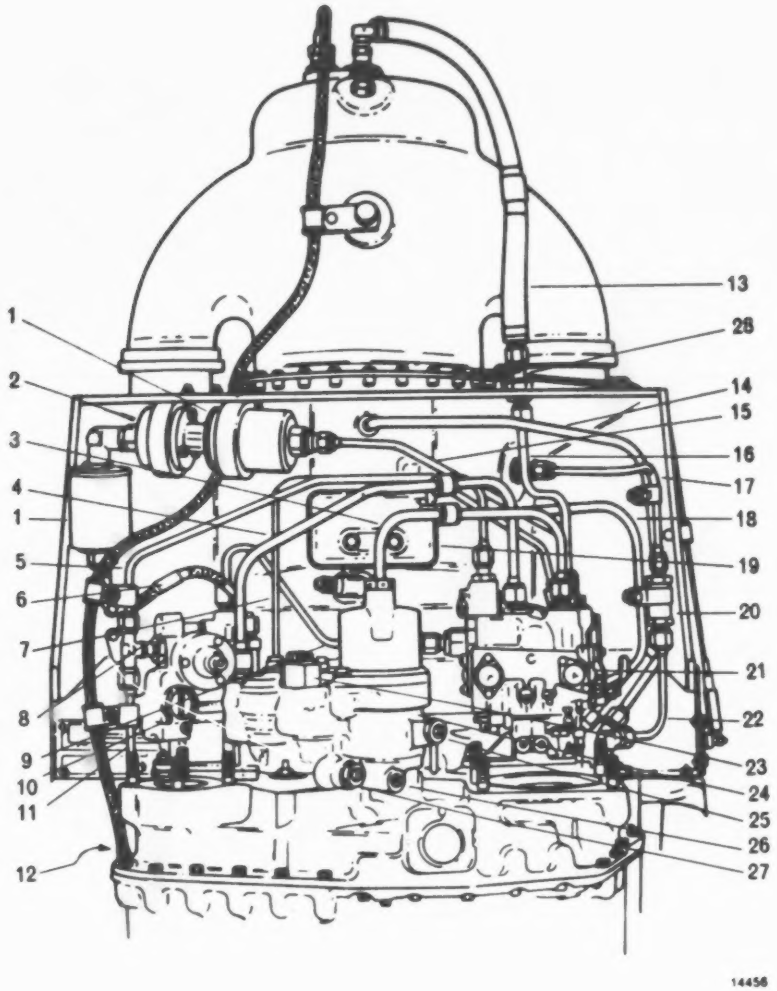
(6) Remove any fuel that may have been spilled in the engine compartment and re-safety the upper bleed port.

5-11. Pc Filter.

a. Removal.

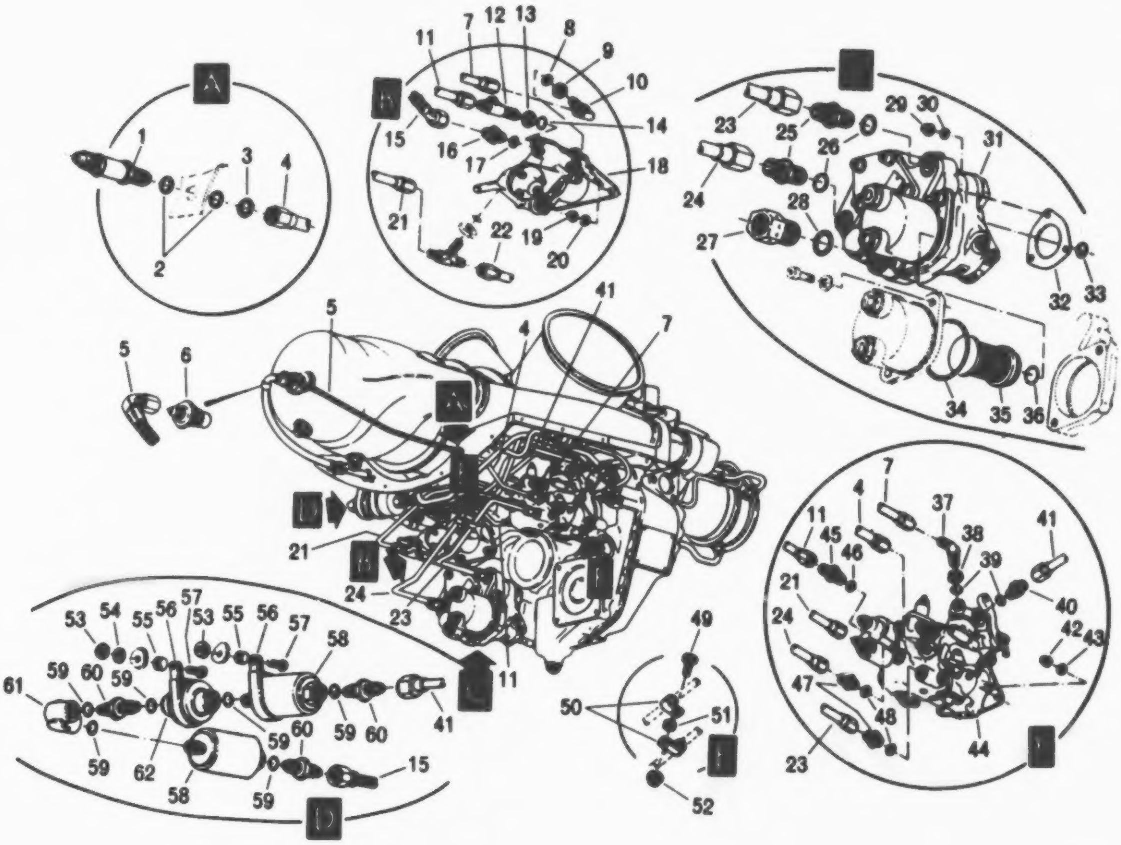
(1) Disconnect air tubes (22, 78, figure 5-3) from both ends of filter (69). Hold the filter while loosening the coupling nuts.

(2) Remove nut (64) and bolt (63) securing filter clamp (65) to filter mounting bracket. Remove the filter and separate the clamp from the filter.



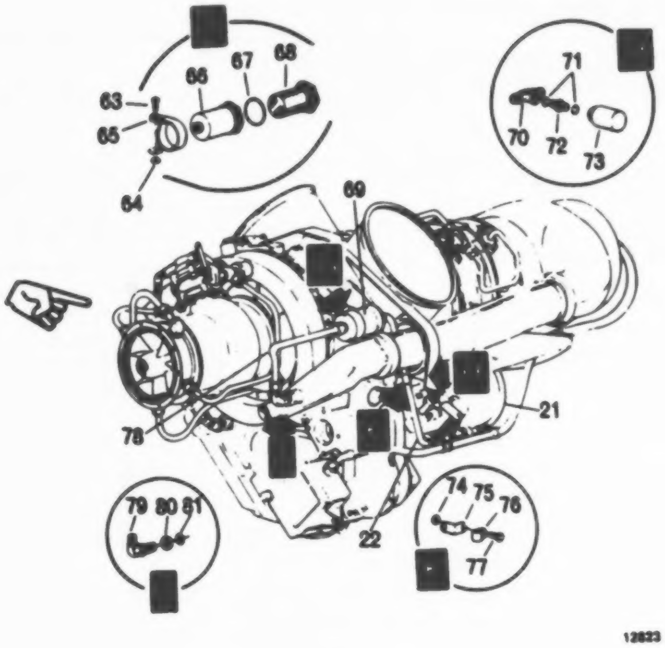
1. Pg accumulator (2)
2. Double check valve
3. Fuel control-to-pump fuel tube
4. Pump-to-control fuel tube
5. Governor-to-fuel control air tube
6. Governor-to-accumulator air hose
7. Fuel control-to-regulator air tube
8. Py accumulator
9. Control-to-governor Py air tube
10. Power turbine governor
11. Pc filter-to-governor air tube
12. Pc air filter
13. Firewall shield-to-fuel nozzle fuel hose
14. Gasifier turbine scavenge oil tube
15. Fuel control-to-accumulator air tube
16. Fuel control-to-firewall shield fuel tube
17. Check valve-to-firewall shield pressure oil tube
18. External sump scavenge oil tube
19. External scavenge oil sump
20. Lube oil check valve
21. Gas producer fuel control
22. Gearbox-to-check valve pressure oil tube
23. Fuel supply inlet port
24. Fuel pump
25. After-filter pressure port
26. Fuel pump seal drain
27. Before-filter pressure port
28. Fuel check valve

Figure 5-2. Fuel, Oil, and Air Tubing


A
B
C
D
E
F
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
12823A

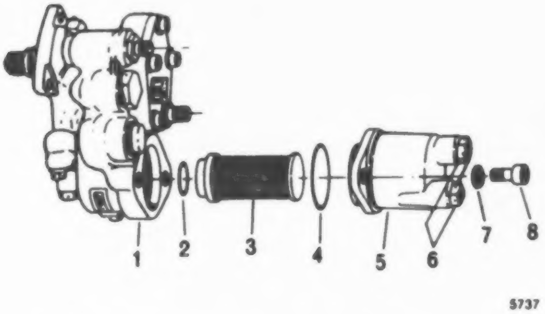
1. Fuel check valve
2. Washer (2)
3. Nut
4. Fuel control-to-firewall shield tube
5. Firewall shield-to-fuel nozzle hose
6. Fuel nozzle
7. Fuel control-to-governor tube
8. **Preformed packing**
9. Nut
10. Elbow
11. Fuel control-to-governor Py tube
12. Tee
13. Nut
14. **Preformed packing**
15. Accumulator-to-governor hose
16. Reducer
17. **Preformed packing**
18. Governor
19. Nut (3)
20. Washer (3)
21. Governor-to-fuel control tube
22. Pc filter-to-governor tube
23. Fuel control-to-pump tube
24. Fuel pump-to-fuel control tube
25. Union (2)
26. **Preformed packing**
27. **Bushing**
28. **Preformed packing**

Figure 5-3. Fuel System Components
(Sheet 1 of 2)



29. Nut (3)
30. Washer (3)
31. Fuel pump
32. Gasket
33. Preformed packing
34. Preformed packing
35. Filter element
36. O-ring
37. Elbow
38. Nut
39. Preformed packing
40. Union
41. Fuel control-to-accumulator tube
42. Nut (3)
43. Washer (3)
44. Fuel control
45. Union
46. Preformed packing
47. Union (2)
48. Preformed packing (2)
49. Bolt
50. Clamp (2)
51. Spacer
52. Nut
53. Nut (2)
54. Washer
55. Spacer (2)
56. Clamp (2)
57. Bolt (2)
58. Accumulator (2)
59. Preformed packing
60. Union (3)
61. Elbow
62. Double check valve
63. Bolt
64. Nut
65. Clamp
66. Housing
67. Metallic O-ring seal
68. Filter element
69. Pc filter
70. Tee
71. Preformed packing
72. Union
73. Accumulator (0.7 cubic in.)
74. Nut
75. Bracket
76. Clamp
77. Bolt
78. Scroll-to-Pc filter tube
79. Pressure probe elbow
80. Nut
81. Preformed packing

Figure 5-3. Fuel System Components (Sheet 2 of 2)



1. Fuel pump
2. Preformed packing
3. Filter element
4. Preformed packing
5. Filter cover
6. Plug (2)
7. Washer (2)
8. Screw (2)

Figure 5-4. Fuel Filter Replacement

b. *Disassembly.* Remove lockwire and separate filter element (68) and preformed packing (67) from filter housing (66). When a vise is used in the disassembly, place the element hex (68) in the vise and use the wrench on the hex of housing (66).

c. *Cleaning.* Clean the filter assembly (68) ultrasonically if equipment is available. If ultrasonic equipment is not available, clean the filter as follows:

(1) Cap the outlet fitting of the filter element with a clean metal cap (AN 820-4 or equivalent).

(2) Wash the filter assembly with solvent and a soft bristle brush.

(3) Dry the filter element with the metal cap removed. Use low pressure air directed from the outside to the inside of the element.

CAUTION

Do not use a cloth to dry the filter element. Lint from cloth could cause contamination.

d. *Inspection.* Inspect the filter assembly for dirt or damage. Replace unserviceable filters.

e. *Assembly.* Apply high temperature lubricant (item 14, table 2-2) lightly to the element (68) threads. Assemble the preformed packing (67) and housing (66) over the filter element. Tighten to 60-65 lft. lb. and secure with lockwire.

f. *Installation.*

(1) Assemble clamp (65) on filter (69) and secure it to the filter mounting bracket with bolt (63) and nut (64). Tighten nut to 35-40 in. lb. Check to ensure that the arrow on the filter is pointing rearward.

(2) Attach air tubes (22, 78) on both ends of the filter. Hold the filter while tightening the coupling nuts to 80-120 in. lb.

5-12. Gas Producer Fuel Control.

a. *Removal.*

NOTE

Before replacing the fuel control to correct an engine malfunction, ensure that the pneumatic tubes and fittings are not leaking and that the double check valve is functioning properly. A malfunction which appears to be a fuel control malfunction may be caused by erroneous pressures.

(1) Remove the self-locking nut and remove the lever from the fuel control.

(2) Remove fuel tubes (3 and 4, figure 5-2) between the fuel pump (24) and control (21). It will not be necessary to disturb the clamping arrangement between the tubes.

(3) Remove fuel tube (16) between the control and fireshield.

(4) Remove air tube (5) between the control and governor.

(5) Remove air tube (7) between the control and governor.

(6) Remove air tube (15) between the control and accumulator.

(7) Remove air tube (9) between the control and governor.

(8) Remove three self-locking nuts and washers (42 and 43, figure 5-3) which secure the control to the gearbox. Carefully remove the control from the mounting studs.

b. *Drive Gear Replacement.*

(1) Remove and discard the retaining ring securing the drive gear on the fuel control drive shaft.

(2) Slide the drive gear, spring, and drive sleeve from the drive shaft.

(3) Coat the splined surface of the drive shaft and drive gear with grease (item 13, table 2-2).

(4) Install the drive sleeve on the drive shaft with the flat side toward the fuel control.

(5) Slip the spring on the drive shaft and engage the straight tang on the end of the spring in the small hole in the drive sleeve.

(6) Engage the straight tang on the opposite end of the spring in the small hole in the drive gear.

(7) Rotate the drive gear 90 degrees clockwise to impose a spring preload and engage the drive gear in the splines of the drive shaft. Slip the drive gear onto the shaft until the drive sleeve and drive gear

segments engage; then install a new retaining ring on the end of the drive shaft.

c. Installation.

CAUTION

When removing or installing fittings in the fuel control, be careful not to cause a load on the drive shaft. Damage to the fuel control could occur.

(1) If a new fuel control is to be installed, transfer the tube fittings from the removed control to the new control. Use new preformed packing. Lubricate preformed packing on fuel tube fittings with oil (item 8, table 2-2). Do not lubricate preformed packing on air tube fittings. Tighten the unions to 75-110 in. lb. Do not tighten jam nuts.

(2) Check the max flow stop setting and adjust if required. (Refer to paragraph 5-12*h*.)

(3) Coat the fuel control drive shaft splines with lubricant (item 14, table 2-2), the studs with antiseize compound (item 15, table 2-2), and fuel tube fittings with oil (item 8, table 2-2).

(4) Install the fuel control on the mounting pad studs. Make certain the fuel control drive splines are properly engaged in the gear box drive splines; the fuel control must be flush against the gearbox mounting pad. Secure the control with three washers (43, figure 5-3) and self-locking nuts (42). Tighten the nuts to 70-85 in. lb.

(5) Install air tube (9, figure 5-2) between the fuel control and governor. Tighten coupling nuts to 80-120 in. lb.

(6) Install air tube (15) between the control and accumulator. Tighten coupling nuts to 80-120 in. lb. Tighten the jam nut on the tube fitting to 55-80 in. lb.

(7) Install air tube (7) between the control and governor. Tighten coupling nuts to 80-120 in. lb. Tighten the jam nut on the tube fitting to 55-80 in. lb.

(8) Install fuel tube (16) between the control and fireshield. Tighten coupling nuts to 80-120 in. lb.

(9) Install air tube (5) between the control and governor. Tighten coupling nuts to 80-120 in. lb

(10) Install fuel tubes (3 and 4) between the fuel pump and control. Tighten coupling nuts to 150-200 in. lb.

(11) Assemble the lever on the control and secure with a self-locking nut. Position the lever in accordance with the Rigging Check. (Refer to paragraphs 5-12*d*.) Tighten the nut to 40-50 in. lb. (Overtorquing causes binding of the lever shaft.)

(12) Check the pneumatic tubes for leaks. (Refer to paragraph 5-8.)

(13) Bleed the fuel system. (Refer to paragraph 5-7.)

(14) Test the engine as outlined in Chapter 10 and make the following adjustments if required.

(a) Idle speed. (Refer to paragraph 5-12*e*.)

(b) Start derichment. (Refer to paragraph 5-12*g*.)

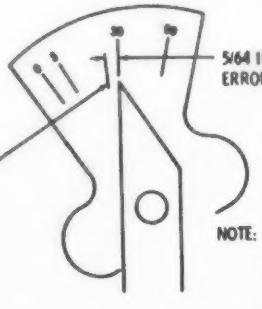
(15) Make appropriate entry relative to fuel control replacement in the engine log.

d. Rigging Check. Check the rigging of the gas producer fuel control after a deceleration check has revealed the deceleration time to be less than the allowable minimum. This check is also required after installation of a fuel control or any component of the rigging system. Make the rigging check with the engine shut down using the following procedure.

(1) Check to ensure that sufficient travel is provided to allow physical contact with the gas producer minimum stop at or before the full closed position of the twist grip.

(2) Check the travel to the opposite end. Physical contact must be made with the gas producer maximum stop at or before the full open position of the twist grip.

(3) Looseness encountered in the rigging must be minimized by replacement of worn items and/or accuracy of the rigging. Looseness that cannot be removed must be within the limits indicated in figure 5-5. Check the looseness as follows:



5/64 IN. MAX ALLOWABLE POSITION ERROR FROM ALL CAUSES

MARK THE QUADRANT OR FABRICATE A TEMPLATE TO SHOW 5/64 IN. BELOW 30 DEGREES.

NOTE: TO GET CONSISTENT AND ACCURATE READINGS ALWAYS VIEW THE QUADRANT FROM SQUARE AWAY.

8797

Figure 5-5. Fuel Control Quadrant and Pointer

(a) Start with the twist grip at the full open position then rotate the grip to the IDLE position. The pointer must be at the 30 degree mark.

(b) Start with the twist grip at the full closed position then rotate the grip to the IDLE position. The pointer must be no more than 5/64 in. below the 30 degree mark.

NOTE

> Make rigging adjustments using the pilots twist grip. Recheck the linkage movement using the copilots twist grip. The limits of figure 5-5 are applicable to both sets of controls.

e. Idle Speed Check. Check the idle speed setting with the engine running. Stabilized idle speed should repeat every time, whetehr the twist grip is slowly rolled or snapped to the IDLE position. Failure of the stabilized idle speed to repeat is cause for a recheck of the rigging. Check for proper idle adjustment rigging as follows:

(1) Roll the twist grip to IDLE and let N1 stabilize. Mark (pencil) the precise position of the pointer tip on the fuel control quadrant.

(2) Release the idle detent on the twist grip. Very slowly roll the twist grip in the direction of cutout just enough to obtain perceptible movement of the pointer tip (approximately the width of the pencil mark). If N1 idle speed decreases take the following corrective action:

(a) If the pointer is at or above the 30 degree mark, rerig the aircraft linkage to move the pointer tip to a point just below the 30 degree mark.

(b) If the pointer is more than 5/64 in. below the 30 degree mark, rerig the aircraft linkage to move the pointer closer to the 30 degree mark.

(3) If N1 idle speed did not change when the twist grip was rolled toward cutoff, very slowly roll the twist grip in the direction of increased power. Obtain perceptible movement of the pointer tip. No increase in N1 speed is permitted before the fuel control pointer indicate 30 degrees. An increase in speed before the pointer reaches 30 degrees indicates the fuel control internal rigging is incorrect; replace the fuel control. An increase at or above the 30 degree mark is normal.

(4) When the rigging is correct, change the idle speed adjustment screw to obtain a 62-64% N1 speed adjustment with generator switch off. (See figure 5-6). Using wrench 6798292, turn the screw counterclockwise to decrease N1 speed. A 1/8 turn adjustment changes engine speed approximately 5%. If N1 speed does not respond to the idle speed screw adjustment, the rigging is establishing idle speed. Rerig is required. If N1 speed does respond to the idle speed screw, make the 62-64% N1 speed setting.

f. Maximum Speed Stop. (See figure 5-6) Adjust screw clockwise to increase or counterclockwise to decrease N1 speed. Do not exceed 105% N1.

NOTE

> If the allowable limit of one of the three main indicators (torque, temperature or N1 speed) cannot be reached in flight, readjust the max speed stop screw. Do not exceed existing torque, temperature or N1 limits.

NOTE

> An engine performance check is required after adjusting maximum speed stop screw (refer to applicable Aircraft Maintenance Test Flight Manual).

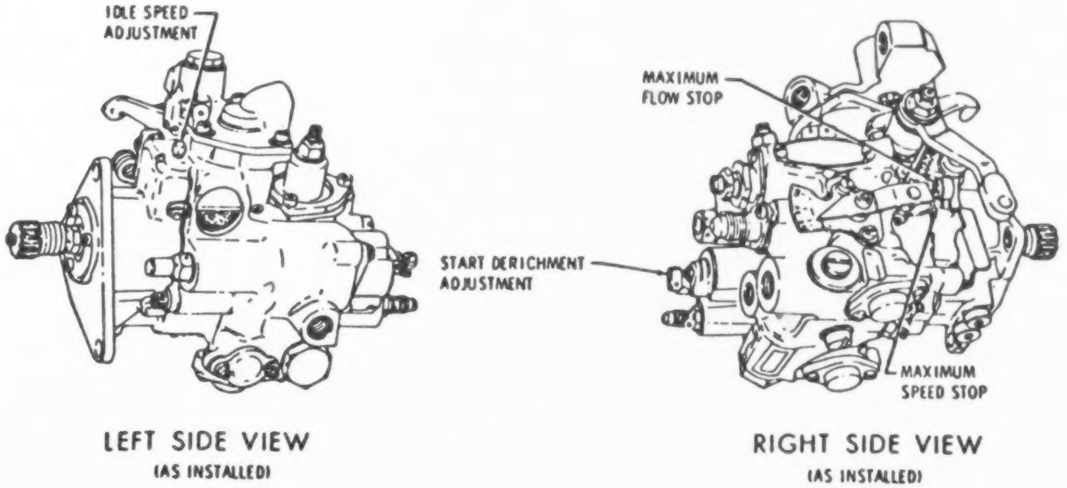


Figure 5-6. Gas Producer Fuel Control Adjustments

g. Engine Starting Characteristics Adjustments. (Refer fig. 5-6A). There are two fuel control adjustments which can be used to change the starting characteristics of the engine. These adjustments are a starting derichment adjustment in addition to a start acceleration adjustment, which is on some engines. The conditions which can be improved by these adjustments are indicated in Table 5-1.

(1) Start-Derichment Adjustment. (Refer to fig. 5-6A). The start-derichment (derich) adjustment can be used to correct lean (slow) start or rich (hot) start conditions. This adjustment es effective below 33% N1 speed. For slow starts at N1 speeds between 35% and 55% N1 speed, refer to Start/Acceleration Fuel Flow Adjustment, subparagraph (2). (Refer to table 5-1).

NOTE

The start derichment adjustment on the latest modified fuel control has a wider angular range than earlier models (200° in place of 100°). Neutral position for the latest control is 7 dots/70° from the counterclockwise stop. Neutral on controls prior to this is a 4 dots/40° counterclockwise. The effective start derichment speed range is between 20% and 33% N1. Also, turning the adjustment to the clockwise stop closes the Py vent which deactivates the start derichment.

NOTE

To accurately determine the proper adjustment, conditions under which the adjustments are made should be consistent, i.e., a fully charged aircraft battery, the same residual TOT and the same lightoff speed.

(a) For low temperature with slow starts at 20-33% N1 speed, adjust the start-derichment as follows:

1 Remove lockwire securing adjustment locknut to Pc filter-fitting.

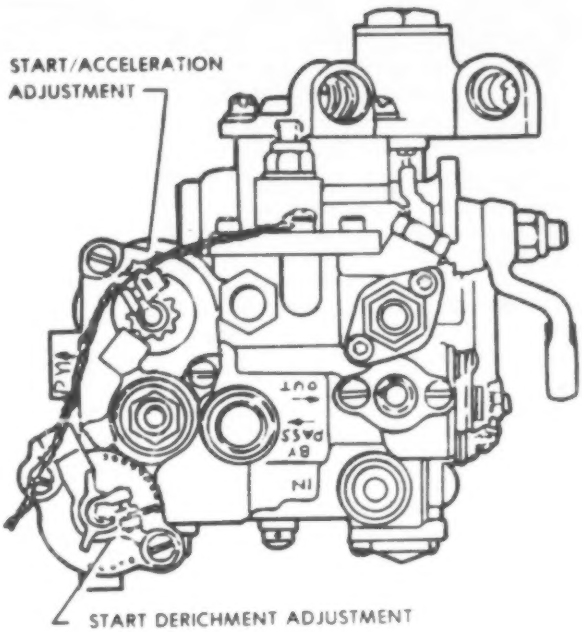
CAUTION

Do not disturb the pointer-to-shaft sealed wire at any time. This is an overhaul function only.

2 Loosen the adjustment locknut.

CAUTION

During attempted start, TOT must be closely monitored to prevent overtemperature operation. Record overtemperature in the Engine Log.



NOTE: Fuel control is shown upside down for clarity when making adjustments.

Figure 5-6.1. Start/Acceleration and Start Derichment Adjustments.

3 Make adjustment using an Allen wrench. Turn clockwise to enrich the starting fuel flow to improve stagnated starts, cold weather starts, or high altitude ground starts. Make adjustment in 15° maximum increments (dots are 10° apart) and tighten locknut to 20-25 lb in. (2.3-2.8 N.m) after each setting. Check the starting peak TOT after each setting until satisfactory starts are made.

4 When desired adjustment is obtained, secure lockout to Pc filter-fitting with lockwire.

CAUTION

Monitor TOT closely after start-derichment adjustment to be sure overtemperature limits are not exceeded.

5 On fuel controls prior to the latest modified, if satisfactory starts are not obtained during steps 1 through 4, proceed as follows:

Table 5-1. Adjustments to Improve Starting.

Condition	Recommended Adjustments
Excessive lightoff temperature — over 810°C (1490°F) with momentary peak of one second max at 927°C (1700°F) for a period not to exceed 10 seconds. N1 speed below 20%.	Adjust start/acceleration counterclockwise. If any additional correction is necessary, adjust start-derichment counterclockwise. (Refer to subparagraphs (1) and (2) for procedures.)
Low lightoff temperature — lightoff temperature below 550°C (1022°F) with N1 speed below 20% and slow acceleration.	Adjust start/acceleration clockwise. (Refer to subparagraph (2) for procedure.)
High rapid temperature rise with N1 speed at 25-30%.	Adjust start/derichment counterclockwise. If any additional correction is necessary adjust start/acceleration counterclockwise. (Refer to subparagraphs (1) and (2) for procedures.)
Low lightoff temperature with slow start — lightoff temperature below approximately 550°C (1022°F) with starting time approaching 60 seconds (or more) and N1 speed hesitation at 20-33%.	Adjust start-derichment clockwise. If additional correction is necessary, adjust start acceleration clockwise. (Refer to subparagraphs (1) and (2) for procedures.)
High lightoff temperature — over 810°C (1490°F) with a momentary peak of one second max at 927°C (1700°F) for a period not to exceed 10 seconds and N1 speed at 35-55%.	Adjust start/acceleration counterclockwise. (Refer to subparagraph (2) for procedures.)
Low lightoff temperature with slow-to-hung starts — lightoff temperature below approximately 550°C (1022°F) with starting time approaching 60 seconds (or more) and N1 speed hesitation at 35-55%.	Adjust start/acceleration clockwise. (Refer to subparagraph (2) for procedure.)

(a) Return start-derich pointer to neutral position; tighten locknut.

(b) Install a short No. 10-32 into vent fitting on the start-derich cover. This deactivates the start-derich assembly and allows operator to check the basic fuel schedule of the control.

(c) Enrich basic schedule slightly by retightening the start-derich cover screws. Remove lockwire from screws, then check screw retention torque. Torque should be 9-10 lb in. (1.02-1.13 N.m). Retighten screws in 2 lb in. (0.23 N.m) increments to a maximum value of 14 lb in. (1.69 N.m). After each 2 lb in. (0.23 N.m) retightening operation, make a start attempt. It is not necessary to remove No. 10-32 screw from vent at this time; this is only a check of the integrity of the basic schedule. If satisfactory starts are obtained, lockwire derich assembly cover screws and remove No. 10-32 screw from vent fitting. Make another start. It may be necessary to adjust the start-derich assembly from the neutral position. After final adjustments have been made, lockwire start-derich assembly.

*(b)*On fuel controls prior to if satisfactory starts are not obtained during steps 1 through 5 above, proceed as follows:

1 Return pointer to the neutral position (4 dots/40° from the counterclockwise stop).

2 Disconnect the fuel control-to-nozzle line at the nozzle. Provide a means of directing fuel that will be discharged from this line into a clean container.

3 Deactivate primary power to the ignition system.

4 Motor engine to approximately 15% N1 speed; then open throttle to the 30° (Ground Idle) position. Motor engine for 15 seconds; then close throttle.

NOTE

This procedure is based upon a 15-second fuel flow. Be sure the throttle is closed exactly 15 seconds after it is opened.

5 Using a calibrated beaker, measure the quantity of fuel in the container. There should be 85-95 cc of fuel in the beaker at sea level. At higher altitudes the flow will be less.

NOTE

For improved accuracy, take the average of three readings.

6 If desired fuel flow is obtained, reinstall the fuel control-top inline check valve tube. Tighten coupling nuts to 80-120 lb in. (9.0-13.6 N.m). If desired fuel flow is not obtained, the fuel control must be removed and recalibrated.

CAUTION

During a start attempt, TOT must be closely monitored to prevent overtemperature operation. Record overtemperature in the Engine Log.

7 Start engine. It may be necessary to adjust the start-derich assembly from the neutral position. After final adjustments have been made and satisfactory starts are obtained, lockwire the start-derich assembly.

c. Rich (hot) starts may be caused by delayed ignition, or premature opening of the throttle. However, hot starts due to high fuel flow are normally caused by the fuel control. When the fuel control is suspected, make an adjustment of the start-derich setting as follows:

1 Remove lockwire and loosen adjustment locknut. (Refer to fig. 5-6A).

2 Make adjustment, using an Allen wrench. Turn counterclockwise to lean-out the fuel flow. Make adjustment in 15° maximum decrements (dots are 10° apart) and tighten locknut after each setting. Check starting peak TOT after each setting until satisfactory starts are made.

3 When desired adjustment is obtained, secure locknut to Pc filter-fitting with lockwire.

4 On fuel controls prior to the latest modification, if satisfactory starts are not obtained during steps 1 through 3 return pointer to neutral position (4 dots/40° from the counterclockwise stop) and proceed as follows:

(a) Inspect to determine that there is no obstruction in vent hole in start-derich cover.

(b) If visual inspection reveals no discrepancies in the start-derich assembly, troubleshoot start-derich assembly by checking for air leakage at the vent while attempting a start. No leakage indicates improper functioning of the start-derich assembly.

CAUTION

During attempted start, TOT must be closely monitored to prevent overtemperature operation. Record overtemperature in the Engine Log.

(c) Check basic fuel schedule by monitoring first TOT indication. TOT should not exceed 860°C (1580°F). If TOT is between 860°C (1580°F) and 927°C (1700°F), remove lockwire from screws. Torque should be 9-10 lb in. (1.02-1.13 N.m). Retighten screws to the minimum value of 9 lb in. (1.02 N.m). Attempt another start. TOT must not exceed 860°C (1580°F). If satisfactory starts are obtained, lockwire derich assembly cover screws and start-derich assembly. If decreasing cover assembly screw torque does not bring start TOT down to the 860°C (1580°) limit, the fuel control must be removed and recalibrated.

(2) Start/Acceleration Fuel Flow Adjustment (Applicable to the Latest Modified Fuel Controls). The start/acceleration fuel flow schedule adjustment maintains the gas producer fuel control starting schedule within acceptable limits during normal service life.

(a) To optimize engine starting, the start-derichment adjustment should be made in conjunction with the start/acceleration adjustment. (Refer to table 5-1).

(b) Remove lockwire and make start/acceleration fuel flow adjustment as follows:

CAUTION

Do not use start/acceleration adjustment to correct normal maintenance items such as misrigging, air leaks, fuel leaks, faulty fuel nozzle, ignition problems, starter-generator systems problems, etc. Do not use the start acceleration adjustment exclusively to improve engine starting. Excessive clockwise settings before encountering over-temperature results in a single high peak TOT over a wide speed range for a large part of the starting time. Use start-derich adjustment with start/acceleration adjustment to optimize engine starting.

NOTE

To accurately determine proper adjustment, conditions under which the adjustments are made should be consistent, i.e., a fully charged aircraft battery, the same residual TOT and the same lightoff speed.

There are eight positions for the adjuster (the neutral position is three clicks from the counterclockwise stop). Detent grooves hold the adjuster in the selected one of these positions without the need of a jam nut.

A required adjustment of more than two clicks clockwise is an indication that the fuel control is not the cause of the problem.

1 For low lightoff temperature or slow/hung starts, turn the adjuster. Make adjustment in changes of one detent (click) at a time.

best copy available

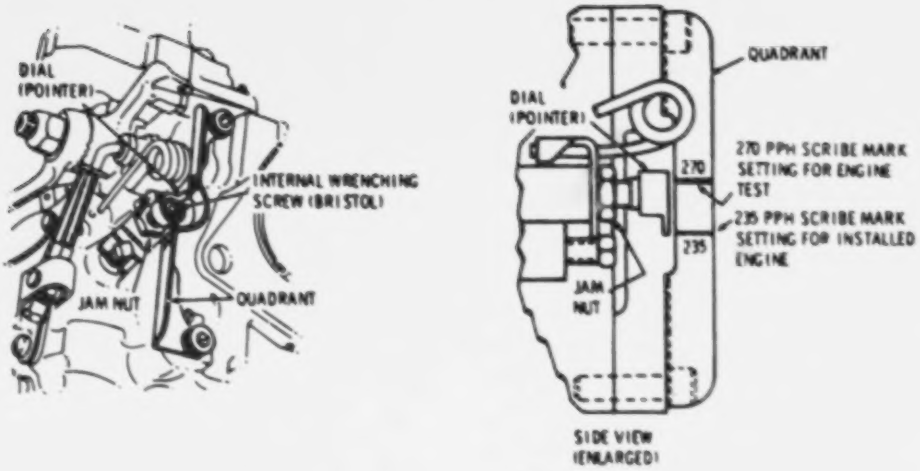

DIAL (POINTER)
INTERNAL WRENCHING SCREW (BRISTOL)
JAM NUT
QUADRANT
QUADRANT
DIAL (POINTER)
270 PPH SCRIBE MARK SETTING FOR ENGINE TEST
270
235 PPH SCRIBE MARK SETTING FOR INSTALLED ENGINE
235
JAM NUT
SIDE VIEW (ENLARGED)

Figure 5-7. Fuel Control Max Flow Stop Adjustment

CAUTION

An over adjustment of the start/acceleration clockwise setting can cause overtemperature starts or compressor surge.

NOTE

If adjuster is positioned to the full clockwise stop and low lightoff temperatures or slow/hung starts are still encountered; ensure there are not pneumatic leaks. (Refer to para. 5-8.)

2 For excessive lightoff temperature starts, turn the adjuster counterclockwise. Make the adjustment in changes of one detent (click) at a time.

CAUTION

An over adjustment of the start/acceleration counterclockwise setting can cause an increase in starting time and possibly a hung start.

3 When the final start/acceleration adjuster position is established, lockwire the pointer in accordance with figure 5-6A.

4. Check idle speed and deceleration time after the final start setting is determined. (Refer to para. 5-12e and para. 5-12i.)

NOTE

An engine performance check is not required for this adjustment.

CAUTION

Monitor TOT closely after start-derichment adjustment to be sure overtemperature limits are not exceeded.

h. Max Fuel Flow Stop Adjustment. This adjustment is required to avoid exceeding the maximum power limit on the OH58C aircraft. The fuel control is bench calibrated to max flows of 235 and 270 pph with the pointer position at these flows scribe marked on the quadrant. The pointer should be set at the 235 pph scribe mark. Make the adjustment as follows:

(1) Remove the lockwire from the jam nut. (See figure 5-7).

(2) Loosen the jam nut while holding the pointer in position with an S1116 Bristol wrench in the internal wrenching screw.

(3) Turn the pointer with the Bristol wrench to the 235 scribe mark. Turn in a clockwise direction.

(4) Hold the pointer at 235 with the wrench while tightening the jam nut to 20-25 in. lb. Secure nut with lockwire.

NOTE

Fuel controls shipped from the manufacturer are set at the 270 pph scribe mark. Fuel controls on new or overhauled engines should be set at the 235 pph scribe mark. Controls which are set at the 270 pph scribe mark must be reset to the 235 pph scribe mark.

i. Deceleration Check. Ground check the fuel control system and associated linkage by performing a deceleration check. This check is applicable only when using alternate fuels and must be performed before the engine has had time to cool down.

NOTE

JP-5 fuel is designated as the Army alternate fuel to be used in the T63-A-720. No deceleration time restrictions are imposed on the engine when the Army primary fuel (JP-4) is used.

NOTE

Perform each step in the sequence listed. Recheck the deceleration rate after each step to determine if there is a need for further correction. Replace the fuel control if the deceleration rate is still unsatisfactory after all steps have been completed.

(1) Turn the generator switch on.

(2) Rotate the twist grip to full open, hold collective at flat pitch and stabilize N2 at exactly 100% (trim as required) for approximately 15 seconds.

(3) Snap the twist grip to the IDLE position. Simultaneously start a time count using a stop watch. Stop the time as the N1 needle passes through 65%. The minimum allowable time is two seconds.

NOTE

Practice and/or retakes may be required before proficiency is obtained in timing the deceleration.

(4) If deceleration time is less than the time allowed make two more checks to confirm the time. If the confirmed deceleation time is less than the allowable minimum perform a rigging check. (Refer to paragraph 5-12*d*.)

(5) Repeat the deceleration check. If the deceleration time is less than the allowable minimum perform an idle speed check. (Refer to paragraph 5-12*e*.).

(6) Repeat the deceleration check. If deceleration time is less than the allowable minimum, replace the fuel control.

j. Cleaning Gas Producer Fuel Control Fuel Filter. Remove, clean and reinstall the fuel control fuel filter assembly as follows. (See figure 5-8.)

(1) Throughly clean exterior of fuel control in the area of the plug to prevent contaminants from getting into the port after it is opened.

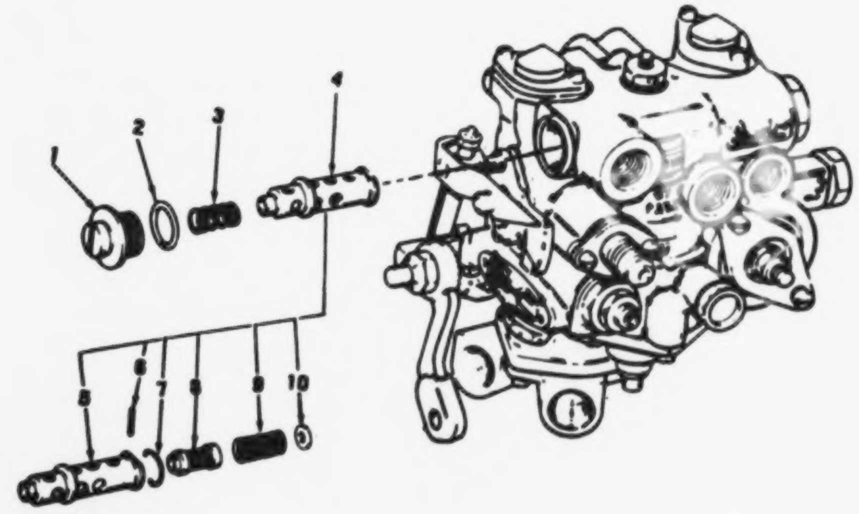
(2) Remove lockwire and remove plug (1), spring (3), and filter asembly (4). Discard preformed packing (2).

(3) Remove retaining clip (7), spring pin (6), and separate washer (10), spring (9), and strainer (8) from filter assembly (4).

CAUTION

Do not attempt to open a clogged screen with a sharp instrument.

(4) Clean filter assembly parts ultrasonically if equipment is available. If equipment is not available, agitate parts in solvent (item 3, table 2-2). Dry parts using clean shop air regulated to approximately 15 psig. Air pressure should be applied to the exterior



1. **Plug**
2. **Performed packing**
3. **Spring**
4. **Filter Assembly**
5. **Filter Sleeve**
6. **Spring Pin**
7. **Retaining Clip**
8. **Strainer**
9. **Spring**
10. **Washer**

Figure 5-8. Fuel Control Fuel Filter

of the strainer. Repeat the procedure if visual inspection with a bright light shows that the interior of the strainer is not entirely free of contaminates.

CAUTION

Be sure strainer (8) is installed as shown in figure 5-8. Open end of strainer toward the outside of the control, away from the spring. Do not install backwards.

(5) Install strainer (8), spring (9), and washer (10) in filter sleeve (5). Secure components in the filter sleeve with spring pin (6) and retaining clip (7).

CAUTION

Use extreme care to insure that the pneumatic lines and fittings are not leaking. Erroneous pressures will cause fuel control malfunction.

(6) Lightly lubricate a new preformed packing (2) with engine fuel and place it on plug (1). Install filter assembly (4), spring (3) and plug (1) in fuel control.

(2) Remove plug (1) and filter assembly (3) from the fuel control. Discard preformed packing (2).

(3) Apply lubricating oil (item 8, table 2-2) to a new preformed packing (2) and place it on plug (1).

(4) Install filter assembly (3) and plug (1) in the fuel control. Tighten the plug to 65-70 in. lb. and lockwire (item 10, table 2-2).

5-13. Power Turbine Governor.

a. Removal.

NOTE

Before replacing the power turbine governor to correct an engine malfunction, ensure that the pneumatic tubes and fittings are not leaking and the double check valve is functioning properly. A malfunction which appears to be a governor malfunction may be caused by erroneous pressures.

(1) Remove the self-locking nut and remove the lever from the governor (10, figure 5-2).

(2) Remove air tube (11) between the Pc filter (12) and governor tee.

(3) Remove air tube (5) between the governor tee and fuel control.

(4) Remove air tube (7) between the governor and fuel control.

(5) Remove air hose (6) between the governor and accumulator (1).

(6) Remove air tube (9) between the governor and control.

(7) Remove three self-locking nuts (19, figure 5-3) and washers (20) securing the governor to the gearbox. Remove the governor from the mounting studs.

b. Drive Gear Replacement.

(1) Remove and discard the retaining ring securing the drive gear on the governor drive shaft.

(2) Slide the drive gear, spring, and drive sleeve from the drive shaft.

(3) Coat the splined surfaces of the drive shaft and drive gear with grease (item 13, table 2-2).

(4) Install the drive sleeve on the drive shaft with the flat side toward the governor.

(5) Slip the spring on the drive shaft and engage the straight tang on the end of the spring in the small hole in the drive sleeve.

(6) Engage the straight tang on the opposite end of the spring in the small hole in the drive gear.

(7) Rotate the drive gear 90 degrees clockwise to impose a spring preload and engage the drive gear in the splines on the drive shaft. Slip the drive gear onto the shaft until the drive sleeve and drive gear segments engage; then install a new retaining ring on the end of the drive shaft.

c. Installation.

CAUTION

When removing or installing fittings in the governor, be careful not to cause a load on the drive shaft. Damage to the governor could occur.

(1) If a new governor is to be installed, transfer the tube fittings from the removed governor to the new governor. Use new preformed packing; do not lubricate. Tighten unions 75-110 in. lb. Do not tighten jam nuts. Tighten Py accumulator to 75-110 in. lb.

(2) Coat the governor drive shaft splines with lubricant (item 14, table 2-2) and the studs with antiseize compound (item 15, table 2-2). Do not lubricate tube fittings.

(3) Install the governor on the mounting pad studs. Make certain the governor drive splines are properly engaged in the gearbox drive splines; the governor must be flush against the gearbox mounting pad. Secure the governor with three washers (20, figure 5-3) and self-locking nuts (19). Tighten the nuts to 70-85 in. lb.

(4) Install air tube (9, figure 5-2) between the control and the governor. Tighten the coupling nuts to 80-120 in. lb.

(5) Install air hose (6) between the governor and accumulator (1). Tighten the coupling nuts to 80-120 in. lb.

(6) Install air tube (7) between the governor and control. Tighten the coupling nuts to 80-120 in. lb. Tighten elbow jam nut to 55-80 in. lb.

(7) Install air tube (5) between the governor tee and the control. Tighten coupling nuts to 80-120 in. lb. Tighten the tee jam nut to 55-80 in. lb.

(8) Install air tube (11) between Pc filter (12) and governor tee. Tighten the coupling nuts to 80-120 in. lb.

(9) Perform a fuel system pneumatic leak check. (Refer to paragraph 5-8.)

(10) Install the governor lever on the governor shaft and position approximately 90 degrees to the centerline of the indicator on the stop assembly. Secure the lever with the self-locking nut. Tighten the nut to 40-60 in. lb. (Overtorquing will cause binding of the lever shaft.)

(11) Adjust the aircraft linkage as outlined in the applicable Aircraft Maintenance Manual.

(12) Test the engine as outlined in Chapter 10.

(13) Make appropriate entry relative to governor replacement in the engine log.

5-14. Double Check Valve.

a. Removal.

CAUTION

Do not torque through the double check valve or accumulators, internal damage could result, use adjacent hexagonal surfaces for turning. When the double check valve or accumulators are removed, use extreme care to prevent foreign materials from entering the pneumatic lines, valve, or accumulators.

(1) Hold union (60, figure 5-3) and disconnect air hose (15) from accumulator (58).

(2) Hold elbow (61) and remove left accumulator (58). Discard preformed packing (59).

(3) Remove nut (53), washer (54), spacer (55), and bolt (57) securing clamp (56) to the firewall shield. Remove the clamp from the check valve.

(4) Hold right accumulator (58) and remove double check valve (62). Remove elbow (61) and union (60) from the double check valve. Discard preformed packing (59).

b. Inspection. Inspect general condition of valve and check associated tubing for cracked coupling nuts and chafed surfaces.

Installation.

(1) Install elbow (61, figure 5-3) and union (60) with preformed packing (59) in double check valve (62). Tighten the elbow and union to 55-80 in. lb.

(2) Place a new preformed packing on right accumulator (58). Do not lubricate the preformed packing. Screw check valve (62) onto the accumulator. Hold accumulator (58) with a backup wrench and tighten the check valve by turning on the narrow hexagonal surface adjacent to the accumulator. Tighten to 55-80 in. lb.

(3) Install clamp (56) on the double check valve. Attach clamp to firewall shield with bolt (57), spacer (55), washer (54), and nut (53). Tighten the nut to 35-40 in. lb.

(4) Place a new preformed packing on left accumulator (58). Do not lubricate the O-ring. Screw the accumulator into elbow (61). Hold elbow (61) with a backup wrench and tighten the accumulator by turning on the narrow hexagonal surface adjacent to the elbow. Tighten to 55-80 in. lb.

(5) Connect air hose (15) to the accumulator and tighten to 80-120 in. lb.

(6) Perform a fuel system pneumatic leak check. (Refer to paragraph 5-8.)

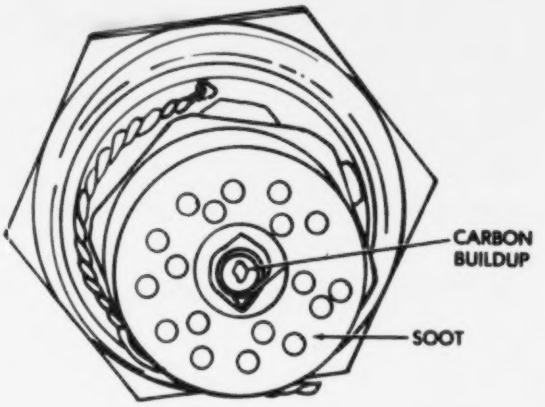


Figure 5-9. Carbon Buildup on Fuel Nozzle

5-15. Fuel Nozzle.

a. Removal.

(1) Disconnect the fuel hose at the fuel nozzle (6, figure 5-3).

CAUTION

Care must be taken when removing the nozzle from the outer combustion case to prevent damage to the nozzle spray tip. If the spray tip is damaged, the nozzle must be replaced.

(2) Remove the lockwire and unscrew the nozzle from the outer combustion case. Carefully extract the nozzle from the combustion case.

NOTE

To preclude the possibility of the combustion chamber becoming misaligned, do not remove the fuel nozzle and the spark igniter at the same time.

b. Cleaning.

(1) Check for carbon deposits on the spray tip. Figure 5-9 shows the condition of a typical fuel nozzle removed from an operational engine. A nozzle in this condition should be cleaned, if possible, before being reinstalled.

CAUTION

Use extreme care to prevent damaging the mirror finish and edge of the spray tip. If finish or spray tip is damaged, the nozzle must be replaced.

(2) Flow air or fuel through the nozzle throughout the cleaning process to prevent carbon from entering the spray tip.

(3) Gently clean the spray tip with a soft cloth dampened with solvent (item 3, table 2-2).

(4) Clean the air shroud face with a clean cloth; air holes must be open. Ensure that loosened carbon does not enter the spray tip.

c. Inspection.

(1) Visually inspect for damaged mirror finish or edge of spray tip. Replace damaged nozzles.

(2) Visually inspect for carbon lodged in the spray tip. Flow fuel through the nozzle and replace if carbon cannot be flushed out.

d. Installation.

NOTE

Do not lubricate the fuel nozzle threads.

(1) Carefully install the nozzle in the outer combustion case and tighten to 200-300 in. lb. Lockwire (item 10, table 2-2) the nozzle to the spark igniter.

(2) Connect the fuel hose to the nozzle. Hold the fuel hose to prevent twisting and tighten the coupling nut to 80-120 in. lb.

5-16. Accumulator.

a. Removal.

CAUTION

Do not torque through the accumulators or double check valve, internal damaged could result. Use adjacent hexagonal surfaces for turning.

(1) Disconnect governor-to-accumulator air hose (15, figure 5-3) at accumulator (58).

(2) Disconnect accumulator-to-fuel control air tube (41) at accumulator (58).

(3) Hold elbow (61) with a backup wrench and remove accumulator (58). Discard preformed packing (59).

(4) Remove nut (53), spacer (55), and bolt (57) securing clamp (56) to the firewall shield. Remove the clamp from accumulator (58).

(5) Hold double check valve (62) with a backup wrench and remove accumulator (58). Discard preformed packing (59).

(6) If a new accumulator is to be installed, remove union (60) from the accumulator. Discard preformed packing (59).

b. Cleaning.

(1) Immerse the accumulators in cleaning solvent (3, table 2-2) and agitate until clean.

(2) Blow accumulators completely dry using filtered dry compressed air.

c. Testing.

(1) Pressurize accumulators using 35 psi air pressure. Replace if leakage is detected.

d. Installation.

(1) If unions (60, figure 5-3) were removed, place new preformed packing (59) on the unions. Install them in the accumulators (58) and tighten to 55-80 in. lb.

CAUTION

Do not torque through the accumulators or double check valve, internal damage could result. Use adjacent hexagonal surfaces for turning.

(2) Place new preformed packing (59) on the male end of accumulator (58). Install the accumulator in elbow (61) and tighten to 55-80 in. lb.

(3) Place new preformed packing (59) on the male end of the accumulator (58). Install the accumulator in double check valve (62) and tighten to 55-80 in. lb.

(4) Assemble clamp (56) on the accumulator. Secure the clamp to the firewall shield with bolt (57), spacer (55), and nut (53). Tighten the nut to 35-40 in. lb.

(5) Connect accumulator-to-fuel control air tube (41) to accumulator (58). Tighten the coupling nut to 80-120 in. lb.

(6) Connect governor-to-accumulator air hose (15) to accumulator (58). Tighten the coupling nut to 80-120 in. lb.

(7) Perform a fuel system pneumatic leak check. (Refer to paragraph 5-8.)

5-17. Fuel System Tubes.

a. Removal. Observe the following precautions when removing tubes.

(1) When loosening a coupling nut, always use a backup wrench on the mating fitting to prevent the fitting from turning.

(2) Always use the proper size wrench to prevent rounding off the hex corners.

(3) Attach the wrench to the fitting or coupling nut in a manner that will prevent crushing of the fitting or coupling nut.

(4) Never use a pipe wrench, pliers, or vise grips on a coupling nut or fitting.

b. Cleaning. Flush tubes with solvent (item 3, table 2-2) and blow dry.

c. Inspection. Inspect and reject tubes for the following damage.

(1) Kinks or dents which could obstruct fuel flow. Dents are allowable up to 0.015 in.

(2) Cracked or broken tubes or coupling nuts.

(3) Cross-threaded, crushed, or otherwise damaged coupling nuts.

(4) Chafing within clamp areas in excess of 0.010 in. deep. Chafing is not allowed at or near the flared tubing end.

(5) Nicks which exceed 0.010 in. deep.

d. Installation.

(1) Observe the precautions listed in removal when installing the fuel tubes.

(2) Tighten No. 4 size coupling nuts 80 to 120 in. lb and No. 5 size coupling nuts 150 to 200 in. lb.

(3) Rigid steel tubing must align with its mating fittings in the free state such that both coupling nuts will engage two full threads of their mating fittings with light finger pressure. The tube must not be stretched during final tightening of the coupling nuts. Adjustments may be made by bending the tube at the principal bend or bends. All bending must be accomplished with the tube removed from the engine. Flattening effect as a result of reforming shall not exceed 15 percent of the tube OD.

5-17.1 Fuel Check Valve.

a. Removal.

(1) Disconnect Fire Shield to Fuel Nozzle Hose (5, Figure 5-3) from fuel nozzle (6) and fuel check valve (1).

(2) Disconnect fuel control-to-firewall shield tube (4) from Fuel Check Valve (1).

(3) Remove nut (3) washer (2) and check valve (1) from the firewall shield.

b. Inspection.

Visually inspect general condition of valve and check associated tubing for cracked or broken tubes or coupling nuts.

c. Installation.

(1) Install the check valve (1) and washer (2) in the fireshield. Install from the aft side with arrow pointing rearward. Secure the valve with washer (2) and nut (3). Tighten 55-80 in. lb.

(2) Install fuel control to check valve tube (4) and fuel nozzle to check valve hose (5). Tighten coupling nuts to 80-120 in. lb.

Section III. LUBRICATION SYSTEM

5-18. Scope.

Lubrication system servicing includes cleaning and inspecting the magnetic chip detectors and oil pressure regulator, changing the system oil, cleaning the oil filter, replacing the oil filter housing, oil pressure reducer, and lube oil check valves. In addition, it includes adjusting the oil pressure regulating valve.

5-19. Use of Oils.

NOTE

It is not advisable to mix MIL-L-7808 and MIL-L-23699 oils except in cases of emergency. If it becomes necessary, the system must be flushed within 6 hours of operation. (Refer to paragraph 5-21.)

NOTE

Nearly all present day lube oils contain anti-foam additives which can settle to the bottom of the container. Thoroughly shake (agitate) the container prior to adding oil to the system either at an oil change or during routine servicing.

a. Use of MIL-L-23699 oil is authorized and directed for ambient temperatures above minus 25°F.

b. Use of MIL-L-7808 oil is specified for operation in ambient temperatures below minus 25°F. This oil may also be used when MIL-L-23699 oil is not available.

5-20. Oil Change Procedure.

Drain and refill the lubrication system after each 100 hours of engine operations as follows:

a. Drain the oil tank.

b. Remove the magnetic chip detector from the bottom of the gearbox and drain residual oil. (Refer to paragraph 5-24.)

c. Remove and clean or replace the oil filter. (Refer to paragraph 5-25.)

d. Refill the oil tank with engine oil (item 7, table 2-2).

e. Remove and clean the magnetic chip detector on the forwardside of the gearbox (refer to paragraph 5-24). While both magnetic plugs are removed, motor the engine with the starter and permit a small amount of oil (1 or 2 ounces) to flow from the openings in the gearbox. This will assist in rinsing the gearbox of carbon particles. Reinstall the cleaned magnetic plugs.

f. Refer to Figure 5-10A. Loosen the fittings and remove the line going to the "T" fittings that feeds oil to the number six and seven bearing, Pressure Oil Tube P6871470. Remove the small oil screen, P6840476 (Pressure Oil Fitting Screen Assembly). Motor the engine with the starter and permit a small amount of oil (1 or 2 ounces) to come out the end of the oil tube. Clean and reinstall the screen and tube assembly. Tighten pressure oil tube coupling nuts to 80 to 120 inch - pounds. Tighten clamp nuts to 35 to 40 inch - pounds.

g. Motor the engine with the starter until positive oil pressure indication is obtained. Do not exceed starter limitations.

h. After all work is completed make a ground run, check for leaks and monitor oil pressure for the first five minutes of engine operation. Check and reservice the oil tank to the proper level.

5-21. Oil Changeover Procedure.

When changing over from MIL-L-7808 oil to MIL-L-23699 oil or vice versa, proceed as follows:

a. Drain the oil tank, system components and piping, and engine gearbox as completely as possible.

b. Remove and clean or replace the oil filter. (Refer to paragraph 5-25.)

c. Remove, inspect, and clean the magnetic chip detectors.

d. Fill the oil tank with the desired lubricating oil (item 7, table 2-2).

e. Motor the engine to pump oil through the system. Check the tank oil level and add oil as required. Repeat the motoring cycle until the tank oil level does not change.

f. Run the engine for 30 minutes to one hour and shut down.

g. Inspect and clean or replace the oil filter.

(1) If the filter was heavily contaminated, accomplish steps *h* through *l*.

(2) If the filter was not heavily contaminated, accomplish steps *j* through *l*.

h. Drain the oil from the engine oil system. (Refer to paragraph 5-20.)

i. Fill the oil tank with the desired oil and release the engine for service.

j. After five hours operation, inspect and clean or replace the oil filter.

k. After 15 hours operation since oil change, inspect and clean or replace the oil filter.

l. Revert to normal schedule of inspection of oil filter.

5-22. Mixing of Engine Oils.

Do not mix MIL-L-7808 and MIL-L-23699 oil except in an emergency. If mixing is necessary, flush the system within six hours of engine operation. (Refer to paragraph 5-21.)

5-23. Oil Tubing and Fittings.

The tubes used in the oil system are rigid stainless steel assemblies incorporating permanent fittings.

a. Inspect oil tubes for kinks, uniformity of diameter, breaks, and freedom from interference with adjoining structure or other components. Replace defective oil tubes.

b. Inspect fittings and hardware for cracks, crossed threads, obstructions in openings, burrs, or other damage. Replace all damaged fittings. Replace all seals, packings, and lockwire when they are removed from a unit.

c. Tighten No. 4 size coupling nuts to 80-120 in. lb and No. 5 size coupling nuts to 150-200 in. lb.

5-24. Magnetic Chip Detectors.

Each chip detector consists of a magnetic plug with a single pin electrical receptacle. The threaded plug portion of the chip detector includes a terminal shaft and pole piece separated from a magnet in the plug body by insulators. When ferrous metal particles are sufficient in size of accumulation to bridge the gap between the pole piece and the magnet, an electrical (ground) circuit between the chip detector and the ENG CHIP DET indicator light is completed.

***a*. *Removal*.** Remove lockwire and unscrew magnetic chip detector. Some oil spilling is likely. Remove preformed packing from plug and discard preformed packing.

NOTE

When removing chip detector, care should be taken not to contaminate detector.

b. *Inspection*.

(1) Visually check each plug for metal accumulation.

(2) Flakes of magnetic material of 1/16 in. or more diameter are indications of an incipient failure and are cause for engine removal. (See figure 5-10.)

(3) Fuzz or hair-like magnetic particles can normally be found on the magnetic plug and are not cause for engine replacement. (See figure 5-10.)

c. *Cleaning*. Wipe chip detectors with a clean, lint-free cloth.

***d*. *Installation*.** Install a new preformed packing lubricated with oil (item 7, table 2-2) on magnetic plug. Install magnetic plug; tighten to 60-80 in. lb and lockwire.

e. *Testing—Chip Detector and Circuitry*.

(1) Place BATT—OFF switch to OFF and apply external power.

(2) Remove chip detector.

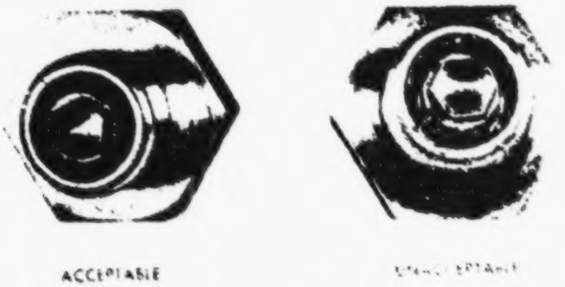


Figure 5-10. Particle Accumulation on Magnetic Chip Detector

(3) Connect the electrical lead to the chip detector and ground the case of the chip detector to the engine.

(4) Using a screwdriver, short across the gap between the pole piece and the magnet and observe ENG. CHIP DET indicator light. If light is on, circuit and detector test good.

(5) If ENG. CHIP DET indicator light does not illuminate, check that case is grounded to engine. If light is still not observed, remove electrical connector from chip detector and ground connector to engine. ENG. CHIP DET indicator light should illuminate. If light does illuminate replace chip detector; if light does not illuminate, check circuits for continuity and replace defective parts.

(6) Reinstall chip detector.

(7) Reinstall electrical connector to chip detector.

(8) With engine running, check the magnetic chip detector light; the light should be out.

5-25. Oil Filter.

a. Removal.

(1) Remove the nuts (1, figure 5-11) and washers (2). Remove cap (3) with preformed packing (4) from housing (9) located on top of engine.

(2) Use a clean suction gun or another suitable device to remove the puddled oil from within the filter housing (9) before removing the filter element (5). Do not damage the filter element. Examine sediment for evidence of metal particles.

(3) Remove the filter element (5) and preformed packing (6) Discard the preformed packing.

(4) Install the cap (3) with preformed packing on housing to prevent dirt from entering the housing.

b. Cleaning.

NOTE

Use ultrasonic cleaning equipment if available.

(1) Agitate filter element in solvent (item 3, table 2-2) until clean.

(2) Air dry filter element.

(3) Thoroughly clean the oil filter cavity of all residual oil and/or sludge prior to the installation of a cleaned or new filter element. If metal particles are present remove and examine magnetic plugs in gear case.

c. Installation.

(1) Remove cap (3, figure 5-11) with preformed packing from housing. Discard preformed packing. Clean cap with a clean lint-free cloth. Install new preformed packing (4) lubricated with engine oil (item 7, table 2-2) on filter cap.

(2) Install new preformed packing (6) and cleaned filter element (5) in filter housing (9).

(3) Install filter cap (3).

(4) Tighten nuts (1) which secure filter cap to housing to 30-45 in. lb.

d. Testing. After the filter element has been cleaned or replaced, run the engine for a short duration and check the splitline for leaks.

5-26. Oil Pressure Regulator.

NOTE

Do not remove the pressure regulator unless the oil pressure cannot be adjusted within limits.

a. Removal. **Remove lockwire and turn guide (14, figure 5-11) out of housing (9). Remove spring (17) and poppet (18) from the housing. Discard preformed packing (16).**

b. Installation.

(1) Lubricate preformed packing (16) with oil (item 7, table 2-2) and place on guide (14).

(2) Install poppet (18), spring (17), and guide (14) in housing (9). Turn the guide in until it bottoms; then back it out 5½ turns.

(3) Adjust the regulating valve as outlined in step *e*.

c. Inspection.

(1) Check the external condition of the regulator; ensure that the regulator is lockwired. If the regulator is not lockwired, check the adjustment as outlined in step *e*.

(2) If oil pressure cannot be adjusted within limits, remove the regulator. Check for a broken spring (17) or evidence of poppet (18) sticking. Check for damage or wear on the poppet seating surface.

d. Testing.

NOTE

Oil pressure limits apply to an engine that is at normal operating temperature.

(1) With the engine running at ground idle, check that the oil pressure is 50 psig minimum.

(2) With the engine operating at maximum speed, check that the oil pressure is within limits. (Refer to table 10-1.)

e. Adjustment.

NOTE

Any adjustment made to the oil pressure regulator should be verified by a calibrated direct-reading pressure gage connected at the oil pressure sensing port on the front of the gearbox.

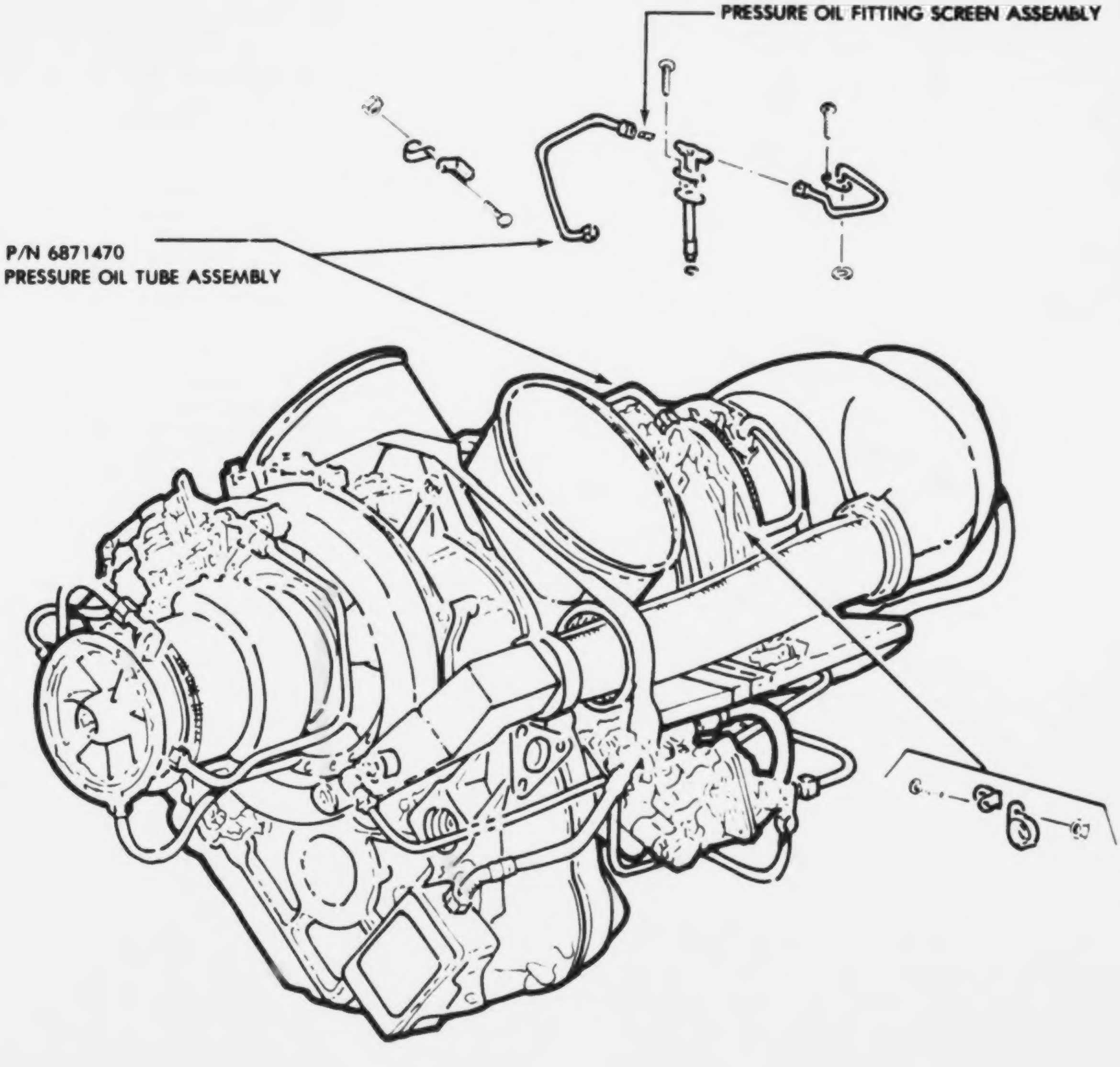

P/N 684078
PRESSURE OIL FITTING SCREEN ASSEMBLY
P/N 6871470
PRESSURE OIL TUBE ASSEMBLY

Figure 5-10A. Pressure Oil Tube and Pressure Oil Filtering Screen

1. **Nut(2)**
2. **Wahser (2)**
3. **Cap**
4. **Preformed packing (2)**
5. **Oil filter**
6. **Preformed packing (2)**
7. **Nut (8)**
8. **Washer (8)**
9. **Housing**
10. **Gasket**
11. **Preformed packing**
12. **Check valve**
13. **Preformed packing**
14. **Guide**
15. **Pin**
16. **Preformed packing**
17. **Spring**
18. **Valve poppet**
19. **Preformed packing**
20. **Preformed packing**
21. **Oil tube**
22. **Oil tube**

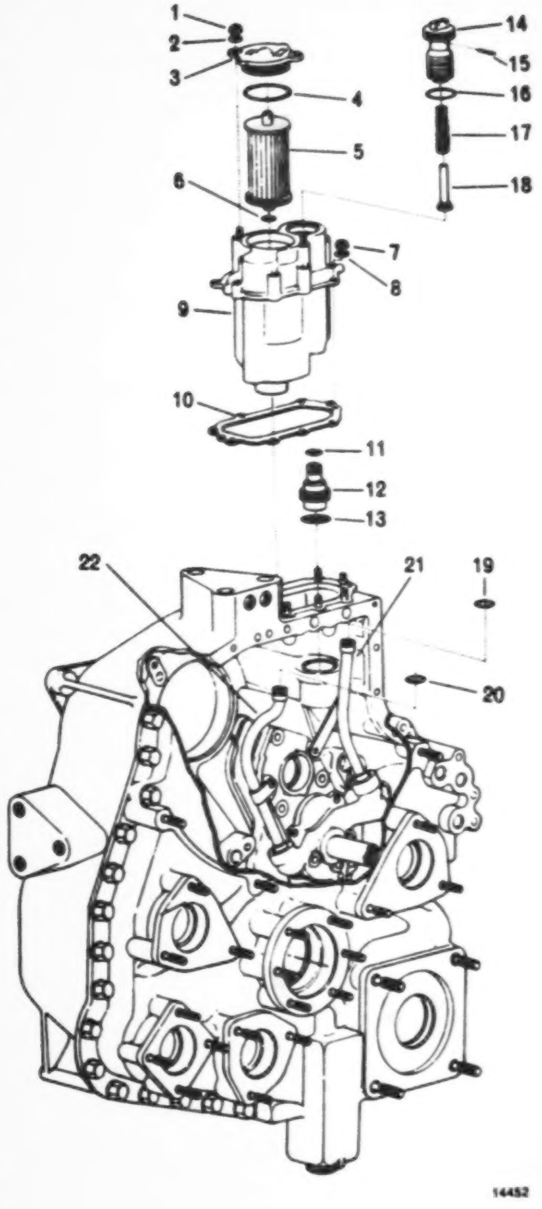

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
14452

Figure 5-11. Oil Filter, Housing, Check Valve, and Regulator Valve

(1) Remove the lockwire from the pressure regulator.

(2) Using a wrench, turn guide (14) clockwise to increase pressure; counterclockwise to decrease. Adjust the regulator until oil pressure is within limits of step *d*. One turn will change oil pressure approximately 13 psig.

NOTE

An approximate starting adjustment can be made by bottoming guide (14); then backing out 5½ turns.

(3) Lockwire guide (14) after adjustment to prevent movement in either direction.

5-27. Oil Filter Housing.

a. Removal.

(1) Remove eight self-locking nuts (7, figure 5-11) and washers (8).

(2) Lift housing (9) out of the gearbox. Discard gasket (10).

(3) Remove check valve (12). Discard preformed packing (11 and 13).

(4) Remove preformed packing (19 and 20) from oil tubes (21 and 22) and sicard preformed packing.

b. Installation.

(1) Lubricate new preformed packing (19 and 20) with oil (item 7, table 2-2) and install on oil tubes (21 and 22).

(2) Lubricate new preformed packing (11 and 13) with oil (item 7, table 2-2) and install on check valve (12). Install the check valve in the gearbox.

(3) Place new gasket (10) on the gearbox.

(4) Insert housing (9) into the gearbox and engage the mounting studs. Ensure that the housing is mated with oil tubes (21 and 22) and with check valve (12).

(5) Retain the oil filter housing with eight washers (8) and self-locking nuts (7). Tighten the nuts to 35-40 in. lb.

5-28. Internal Oil Check Valve.

The internal oil check valve (12, figure 5-11) is located under the oil filter housing (9), inside the gearbox. It serves to prevent oil from draining out of the oil tank and into the gearbox while the engine is shut down.

a. Removal. (Refer to paragraph 5-27*a*.)

b. Cleaning. Clean the internal check valve by flushing with solvent (item 3, table 2-2) and air dry.

c. Installation. (Refer to paragraph 5-27*b*.)

5-29. External Oil Check Valve.

The external oil check valve (4, figure 5-12) is located in the oil supply tube to the turbine. It serves to prevent oil from draining into the turbine bearing cavities while the engine is shut down.

a. Removal.

(1) Remove self-locking (5) and bolt (1) that secure clamps (2 and 3) together.

(2) Loosen the two oil tube coupling nuts and remove check valve (4) from the engine.

b. Cleaning. Clean the external check valve by flushing with solvent (item 3, table 2-2) and air dry.

c. Deleted.

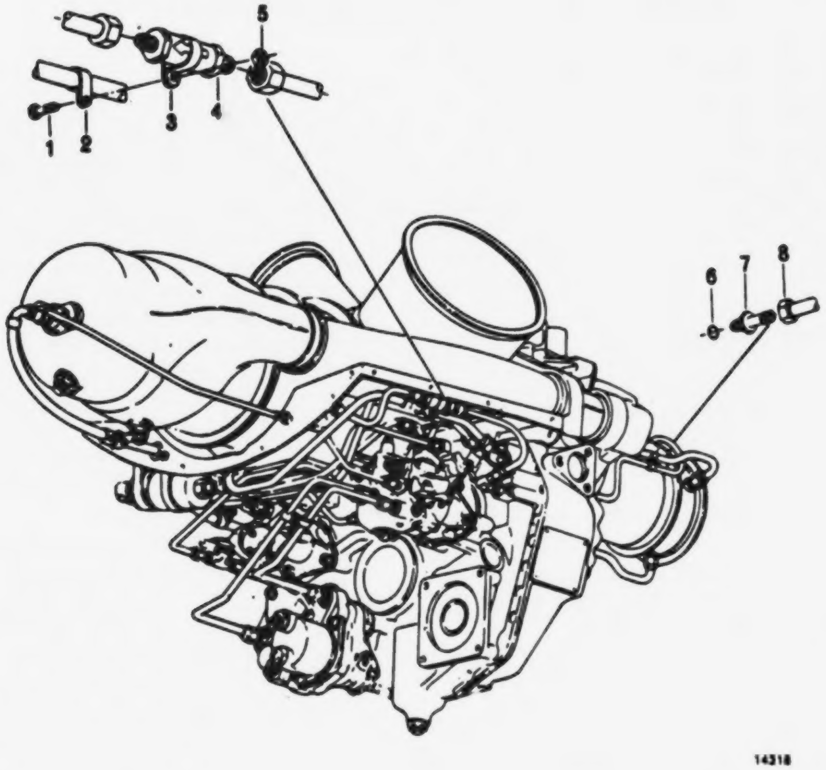
d. Installation.

CAUTION

To prevent oil drainage into turbine bearing cavities, be sure the check valve is installed with the end marked "OUT" and the arrow pointing toward the rear of the engine.

(1) Install check valve (4) on the pressure oil tube with the hex end marked "OUT" and the arrow pointing toward the rear of the engine. Tighten the coupling nuts to 80-120 in. lb.

(2) Secure clamps (2 and 3) together with bolt (1) and nut (5). Tighten the nut to 35-40 in. lb.



1. Bolt
2. Clamp
3. Clamp
4. Check Valve
5. Nut
6. Preformed packing
7. Oil pressure reducer
8. Oil tube

Figure 5-12. External Oil Check Valve

5-30. Oil Pressure Reducer.

a. Removal.

(1) Disconnect the oil tube (8, figure 5-12) from the oil pressure reducer (7).

(2) Remove the oil pressure reducer from the compressor front support. Discard preformed packing (6) and oil pressure reducer (7).

b. Installation.

(1) Lubricate new preformed packing (6) with oil (item 7, table 2-2) and place on new oil pressure reducer (7).

(2) Install the oil pressure reducer on the compressor front support and tighten to 50-75 in. lb.

(3) Connect the oil tube (8) to the oil pressure reducer and tighten coupling nut to 65-100 in. lb.

Section IV. ANTI-ICING AND BLEED AIR SYSTEMS

5-31. Scope.

Anti-icing and bleed air systems servicing includes replacing and testing the compressor bleed valve and anti-icing air valve. In addition, it includes anti-icing valve repair.

5-32. Anti-icing Air Valve.

a. Removal.

(1) Disconnect air tubes (23 and 26, figure 5-13) at the anti-icing air valve (29). Disconnect the air tubes at the compressor front support only if necessary.

(2) Disconnect the aircraft linkage from the valve lever.

(3) Remove lockwire, loosen jam nut (24), and unscrew the valve from the diffuser scroll. Discard preformed packing (25).

b. Testing.

(1) Apply 100 psig air pressure to the valve inlet.

(2) Apply 3.75 pounds maximum force to hold the lever in the closed position.

(3) Leakage shall not exceed 0.076 pounds per minute (as determined by the pressure drop across a 0.025 in. orifice).

(4) If leakage is excessive, replace the seat on the valve poppet and retest.

c. Anti-icing Valve Poppet Seat Replacement. Replace the Teflon poppet seat of the anti-icing valve as follows:

(1) Remove the cotter pin (17, figure 5-13), washer (16), and pin (14). Detach the actuating lever (13) from the valve. Discard the cotter pin.

(2) Remove the lockwire and unscrew the poppet guide (15) from the valve body (22). Separate the poppet (18) from the body.

(3) Remove the screw (21) and separate the poppet seat (20) from the poppet.

(4) Clean valve components in cleaning solvent (3, table 2-2).

(5) Inspect valve components per table 5-2.

(6) Install the replacement poppet seat (20). Retain the seat with screw (21). Stake the screw securely. (See figure 5-14.)

(7) Insert the poppet and seat into the valve body (22, figure 5-13) and screw the poppet guide (15) onto the body. Tighten the coupling nut to 65-75 in. lb. Do not lockwire at this time.

(8) Align the actuating lever (13) with the hole in the poppet guide (notch in the lever toward the guide) and insert the pin (14). Secure the pin with washer (16) and new cotter pin (17).

(9) Recheck the valve for leakage. Replace valve assembly if leakage is still excessive.

d. Installation.

(1) Place new preformed packing (25) with backed-off jam nut (24) on anti-icing valve (29). Apply antiseize compound (item 15, table 2-2) lightly to the threads and install the valve in the diffuser scroll. Do not tithten jam nut (24).

(2) Connect air tubes (23 and 26) to the valve. Tighten the coupling nuts to 150-200 in. lb. Tighten jam nut (24) to 100-150 in. lb and lockwire (item 10, table 2-2).

(3) Loosen poppet guide (15) and position lever (13) parallel with the vertical centerline of the engine. Tighten the poppet guide to 65-75 in. lb and lockwire (item 10, table 2-2).

5-33. Compressor Bleed Valve.

***a. Testing.* Test the compressor bleed valve while installed on the engine. Turn off all bleed air.**

(1) Pilot and observer use helmets and extension cord to passenger communication box.

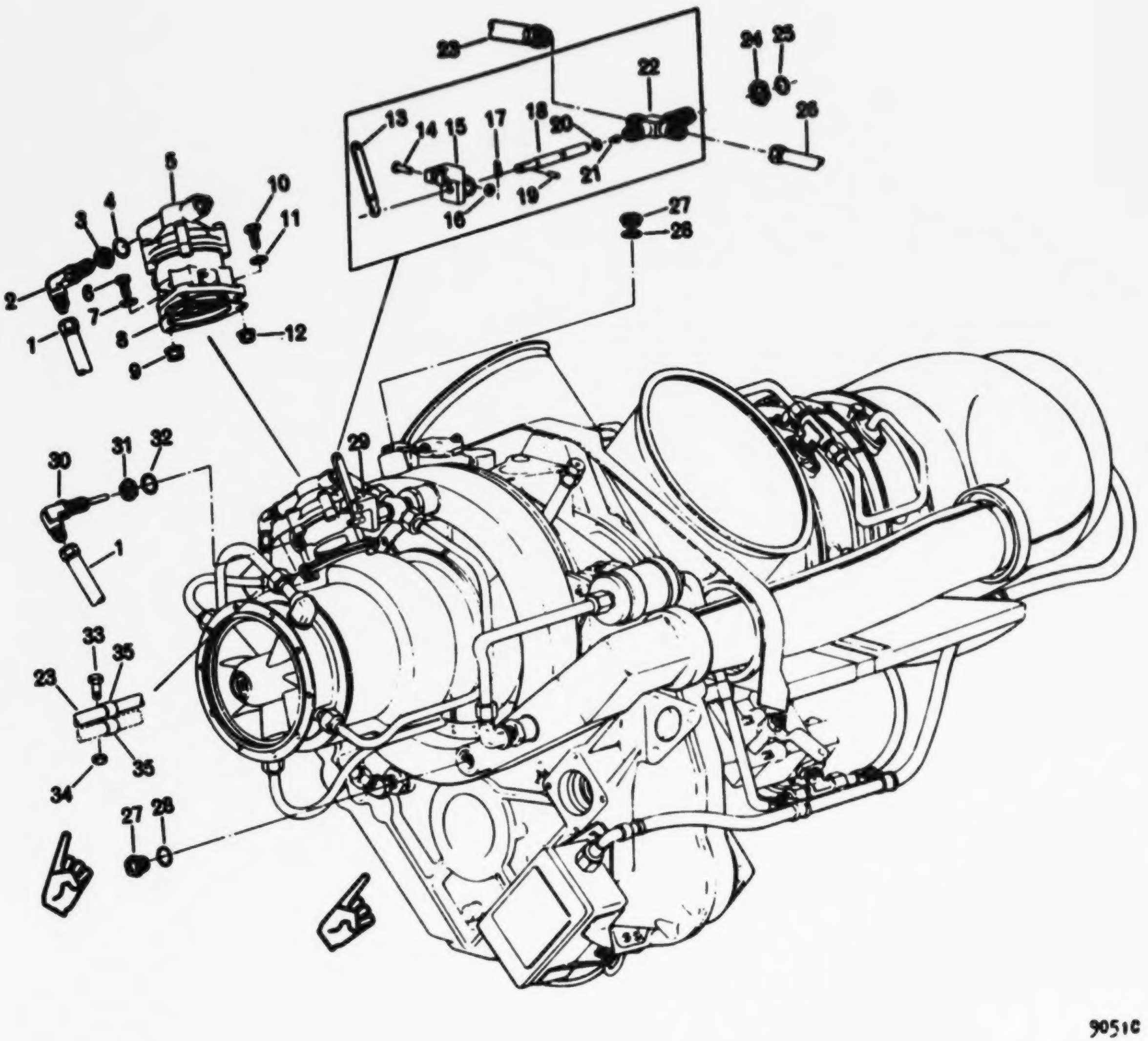
(2) Observer use flashlight to view operation of the bleed valve.

(3) Run up engine to 100% N2 and observe compressor bleed valve operation. Valve should not be fully closed.

(4) Apply collective until valve is fully closed.

NOTE

It may be necessary to increase aircraft gross weight to accomplish run-up.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
9051C

1. Air Sensing Tube
2. Elbow
3. Nut
4. Preformed Packing
5. Bleed Valve
6. Bolt (2)
7. Washer (2)
8. Gasket
9. Nut (2)
10. Bolt
11. Washer
12. Nut
13. Lever
14. Pin
15. Poppet Guide
16. Washer
17. Pin
18. Poppet
19. Pin
20. Poppet Seat
21. Screw
22. Valve Body
23. Anti-icing Tube (RH)
24. Nut
25. Preformed Packing
26. Anti-icing Tube (LH)
27. Plug (2)
28. Preformed Packing (2)
29. Anti-icing Valve
30. Pressure Probe Elbow
31. Nut
32. Preformed Packing
33. Bolt
34. Nut
35. Clamp (2)

Figure 5-13. Engine Air Systems (Anti-icing and Bleed Air)

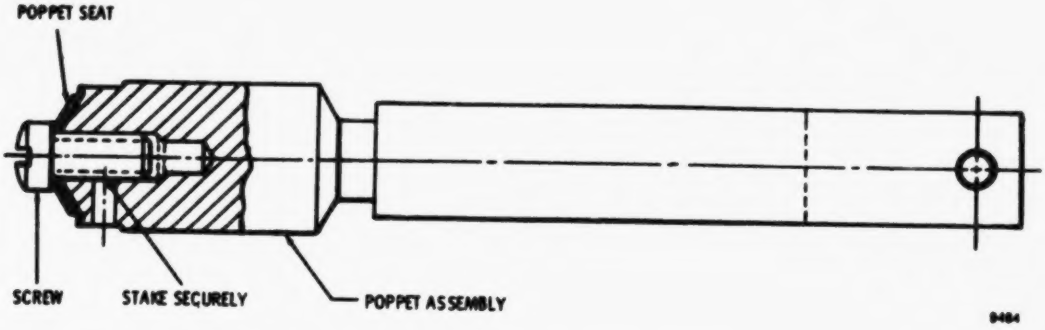


Figure 5-14. Anti-icing Valve Poppet Seat Replacement

Table 5-2. Anti-icing Air Valve Inspection and Repair

Item	Condition	Serviceable Limit	Repairable Limit	Disposition
1	Lever wear at poppet mating surface (creating flat).	Max flat length of 1/16 in.		Repair by grinding rounded end in accordance with figure 5-15 or replace lever.
2	Wear at hole for airframe linkage.	Remaining wall thickness not less than 0.040 in.		Repair or replace lever.
3	Nicks or scratches in flared tube sealing surfaces of valve body.	None.		Repair or replace valve body.
4	Stripped or crossed threads on valve body or coupling nut of the poppet guide.	None.	Max of one damaged thread per connection.	Chase threads.
5	Poppet wear.	Max wear step of 0.005 in.		Replace poppet.
6	Poppet seat damage or wear (excessive valve leakage).	None.		Replace seat.

(5) With the engine at 100% N2 and the compressor bleed valve closed, set the friction lock on collective and rotate the twist grip to flight idle and let N1 stabilize. The bleed valve should be fully open.

(6) Slowly rotate the twist grip toward open. Record the N1 speed at which the compressor bleed valve starts to close.

(7) Continue rotating the twist grip and record N1 speed at which the compressor bleed valve is fully closed.

(8) Compare the recorded N1 speeds for figure 1-9. Clean the compressor bleed valve (refer to para 7-7) if range of figure 1-9 is not met and retest. Replace the bleed valve if it does not operate within the range on figure 1-9.

b. Removal.

(1) Disconnect the compressor discharge pressure sensing tube (1, figure 5-13) at compressor bleed valve (5). (Disconnect tube at the diffuser scroll pressure probe elbow only if necessary.)

(2) Remove three nuts (9, 12), bolts (6, 10) and washers (7, 11); remove valve (5) and gasket (8). Discard the gasket.

(3) If valve is to be replaced, remove lockwire, loosen jam nut (3) and unscrew elbow (2) from the bleed valve. Discard preformed packing (4).

c. Installation.

(1) Install compressor bleed valve (5) and new gasket (8) on mounting flange. Retain with three nuts (9, 12), bolts (6, 10) and washers (7, 11). Apply antiseize compound (item 15, table 2-2) to the bolts. The 1/4-28 bolt goes in the left hole (looking forward). Tighten nut on 1/4-28 bolt to 70-85 in. lb. and the other two nuts to 35-40 in. lb.

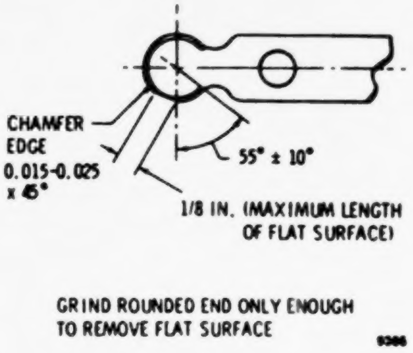

CHAMFER EDGE 0.015-0.025 x 45°
55° ± 10°
1/8 IN. (MAXIMUM LENGTH OF FLAT SURFACE)
GRIND ROUNDED END ONLY ENOUGH TO REMOVE FLAT SURFACE
9366

Figure 5-15. Anti-icing Valve Lever Repair

(2) Lubricate preformed packing (4) with oil (item 7, table 2-2) and place on elbow (2). Install the elbow in the bleed valve. Do not tighten the jam nut.

(3) Attach compressor discharge pressure sensing tube (1) to valve elbow (2). Tighten coupling nut to 80-120 in. lb. Tighten jam nut (3) to 55-80 in. lb.

Section V. IGNITION SYSTEM

5-34. Scope

Ignition system servicing includes replacing and testing the ignition exciter, spark igniter and igniter lead.

5-35. Ignition Exciter.

a. Removal.

WARNING

To prevent personnel injury due to electrical shock, ensure ignition system has been off at least five minutes before disconnecting any leads. Ground leads to engine using an insulated screwdriver.

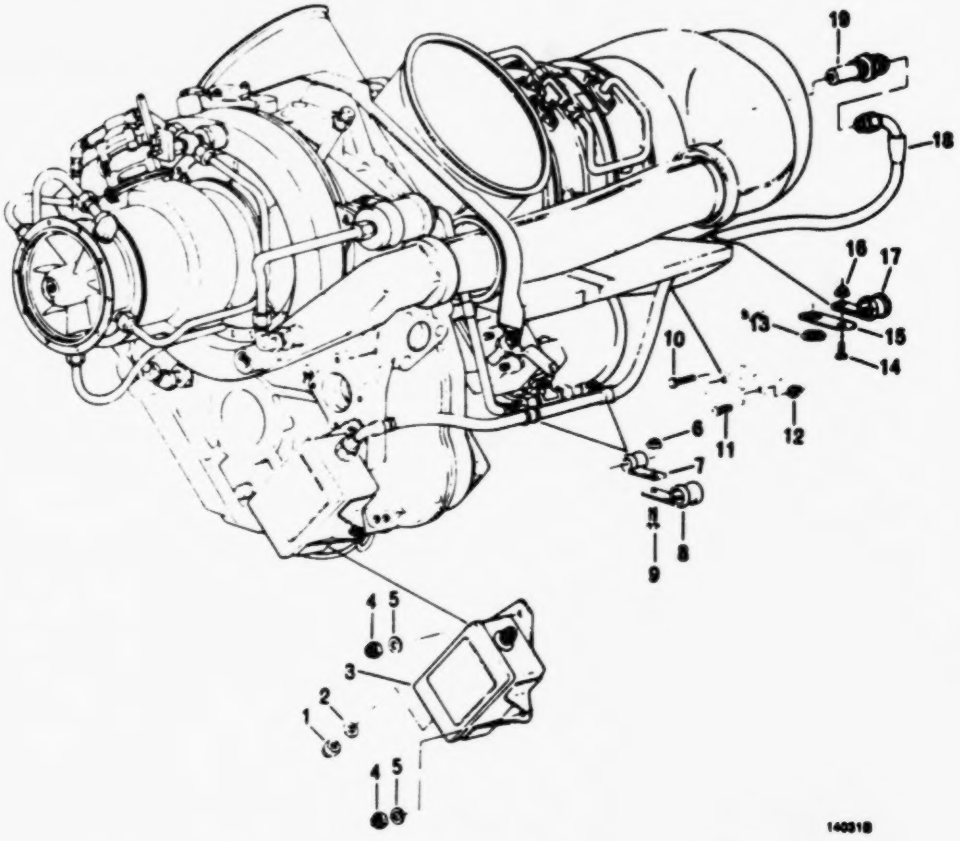
(1) Remove nut (1, figure 5-16) and washer (2) and disconnect power input lead from the exciter (3).

(2) Disconnect igniter lead (18) from the exciter.

(3) Remove threee nuts (4) and washers (5) securing exciter (3) to the gearbox housing. Remove the exciter.

b. Inspection.

(1) Visually inspect for general condition of exciter, input power terminal, and igniter lead connector. Nicks, dents, etc. are acceptable if damage does not extend through the case or cover. Bent or misaligned electrical connector is acceptable if the connector base is not excessively distorted, bulged, or cracked. The connector ends must assemble properly with no evidence of internal damage.



1. Nut
2. Washer
3. Exciter
4. Nut (3)
5. Washer (3)
6. Nut (2)
7. Clamp (2)
8. Clamp (2)
9. Bolt (2)
10. Bolt
11. Bolt
12. Nut (2)
13. Nut
14. Bolt
15. Bracket
16. Nut
17. Clamp
18. Igniter lead
19. Spark igniter

Figure 5-16. Ignition System

(2) Connect a known satisfactory igniter lead and spark igniter of type used on engine to the ignition exciter.

CAUTION

Do not energize ignition exciter if spark igniter and lead are disconnected. Damage to exciter could occur.

(3) Apply 28 volts dc to the input terminal of the ignition exciter using a nimimum wire size of 16 gauge. Observe firing. If a repetitive spark rate of less than six sparked per second is observed, replace the ignition exciter.

CAUTION

Do not operate the exciter for more than 4 minutes in any 30 minute period. Damage to exciter could occur.

c. Installation.

(1) Install serviceable exciter on the engine and secure with three nuts (4) and washers (5). Tighten nuts (4) to 30-40 in. lb.

(2) Attach igniter lead (18) to the exciter. Tighten coupling nut to 50-70 in. lb.

(3) Attach power input lead to the exciter input terminal. Secure with washer (2) and nut (1). Tighten nut to 8-12 in. lb.

5-36. Spark Igniter.

a. Removal.

WARNING

To prevent personnel injury due to electrical shock ensure ignition system has been off for at least five minutes before removing igniter to dissipate all energy stored in condenser. Ground igniter lead to engine using an insulated screwdriver.

(1) Disconnect igniter lead (18, figure 5-16) at igniter (19). Prevent lead from twisting while removing nut.

(2) Separate lead from igniter by pulling straight out without any rotational motion.

(3) Remove lockwire and unscrew igniter (19).

CAUTION

The igniter connector well must be kept dry and free from foreign material. Damage to igniter and igniter load could result.

b. Cleaning.

(1) Clean igniter connector well with a clean dry cloth. Do not wash with solvent.

CAUTION

Under no circumstances, wire brush, sand blast, vapor blast, or scrape the igniter. Any of these cleaning methods can damage the semiconductor.

(2) Normal soot or carbon formation on the tip is not detrimental to igniter operation and need not be removed. If cleaning is desired, wipe the metal tip with a soft dry cloth.

(3) Remove any sizeable carbon deposits with a blunt nonmetallic instrument. Be careful not to damage the semiconductor material.

c. Inspection.

(1) Inspect center electrode; replace igniter if electrode is loose. (See figure 5-17.)

(2) Inspect ceramic for cracks; if any cracks are visible through carbon coating, replace igniter.

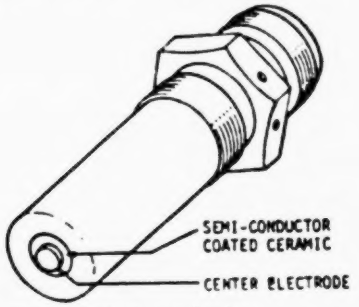


Figure 5-17. Spark Igniter

d. Testing.

(1) With a good exciter and igniter lead, check igniter operation before installing in engine.

(2) Apply 28 volts dc to the exciter; observe the rate of firing. Normal operation is six sparks per second minimum.

(3) Replace igniter if it fails to fire or fires intermittently.

e. Installation.

(1) Install serviced or new igniter; tighten to 150-200 in. lb. and lockwire (item 10, table 2-2) to fuel nozzle.

(2) Connect igniter lead, tighten, to 70-90 in. lb

5-37. Spark Igniter Lead.

a. Removal.

WARNING

To prevent personnel injury due to electrical shock ensure ignition system has been off for at least five minutes before disconnecting igniter lead. Ground lead to engine using an insulated screwdriver.

(1) Remove the lead (18, figure 5-16) from the ignition exciter (3) and the spark igniter (19).

(2) Remove bolts (9) and nuts (6) securing clamps (7 and 8) together.

(3) Remove bolt (14) and nut (16) securing clamp (17) to bracket (15).

(4) Remove two bolts (10 and 11) and nuts (12) securing the lead to the fireshield. Remove the lead.

NOTE

Bolt (10) also secures the accumulator bracket and spacer to the fireshield.

b. Inspection.

(1) Inspect the outer part of the lead for braid damage; replace lead if there are more than five broken strands in any localized area, the braided conduit is punctured, or discolored and brittle from extreme heat.

(2) Inspect terminals of lead to ensure all parts are intact and no pitting is evident; replace lead if any part is missing or pitting is present.

c. Installation.

(1) Insert the igniter lead (18) through the hold in the fireshield. Secure the lead to the fireshield with bolt (11) and nut (12). Secure accumulator clamp, spacer, and igniter lead with bolt (10) and nut (12). Tighten the nuts to 35-40 in. lb.

(2) Connect the igniter lead to the ignition exciter (3) and tighten the coupling nut to 50-70 in. lb.

(3) Connect the igniter lead to the spark igniter (19) and tighten the coupling nut to 70-90 in. lb.

(4) Secure the lead to the air tubing at the power turbine governor with four clamps (7 and 8), two bolts (9) and nuts (6). Tighten the nuts to 35-40 in.lb.

(5) Secure the igniter lead to bracket (15) with clamp (17), bolt (14) and nut (16). Tighten the nut to 35-40 in. lb.

d. Ignition System Check. The following procedure can be used to check the operation of the ignition system.

NOTE

To preclude the possibility of the combustion chamber becoming misalined, do not remove the fuel nozzle and the spark igniter at the same time.

(1) Remove the spark igniter lead (18) from the spark igniter.

(2) Remove the spark igniter (19).

CAUTION

To prevent damage to the igniter, when assembling or disassembling a lead and an igniter which is not installed on the engine, turn the lead nut and not the spark igniter.

(3) Attach the spark igniter lead to the spark igniter.

(4) Apply 28 volts dc across the ignition exciter. Observe or listen for spark.

(5) Install spark igniter and spark igniter lead on the engine. Tighten the spark igniter to 150-200 in. lb. and lockwire to the fuel nozzle. Tighten the lead to 70-90 in. lb.

Section VI. MISCELLANEOUS ACCESSORIES

5-38. Burner Drain Valve.

a. Removal.

(1) Remove lockwire and remove nut (16, figure 3-8) from the drain valve (14). Disengage bracket (15) and remove the drain valve from the outer combustion case. Discard preformed packing (13).

b. Cleaning.

(1) Soak the valve in solvent (item 16, table 2-2).

(2) Flush the valve with petroleum solvent (item 3, table 2-2). Pass solvent through the valve to ensure that it is open.

(3) Blow dry with clean compressed air.

c. Testing.

Test the valve to ensure that it closes by applying air pressure (8 psig maximum) to the valve inlet or test as described in paragraph 5-38*d* (2).

d. Installation.

(1) Lubricate new preformed packing (13) with oil (item 7, table 2-2) and place on drain valve (14). Install the drain valve in the outer combustion case and tighten to 120-140 in. lb. Apply antiseize compound (item 15, table 2-2) to the threads on the outer end of the drain valve and install bracket (15) and nut (16). Tighten the nut to 55-80 in. lb. and lockwire (item 32, table 2-2).

(2) Start the engine and check to ensure that the valve is closed. Replace the valve if it fails to close.

(3) Attach the drain hose to the valve.

5-39. Thermocouple Terminal Assembly.

a. Removal.

(1) Remove the two nuts securing the thermocouple leads to the terminal assembly.

(2) Remove the two nuts and bolts securing the terminal assembly to the exhaust collector.

b. Installation.

(1) Position the terminal assembly on the exhaust collector with the large terminal to the top and secure with two bolts and self-locking nuts. Tighten the nuts to 35-40 in. lb.

(2) Attach the alumel leads to the top post on the terminal assembly and secure with the No. 10-32 alumel nut. Tighten the nut to 17-25 in. lb.

(3) Attach the chromel leads to the bottom post on the terminal assembly and secure with the No. 8-32 chromel nut. Tighten the nut to 17-25 in. lb.

CHAPTER 6

ENGINE DISASSEMBLY

6-1. Scope.

This chapter provides sequential disassembly procedures for major functional assemblies. Procedures are provided for disassembly only to the extent necessary for Aviation Unit and Aviation Intermediate Maintenance activities to perform cleaning, inspection, repair, and/or replacement of provisioned parts in accordance with the Maintenance Allocation Chart and TM 55-2840-241-23P.

6-2. Compressor Case Half Removal.

One compressor case half may be removed to inspect the rotor blades, stator vanes, plastic coating, and front support welds. (Refer to paragraphs 7-9 thru 7-12.) Removal of the compressor case half is authorized only as a last resort to determine the cause of low engine performance or when foreign object damaged (FOD) is suspected. Before removing the case half ensure that low engine performance is not caused by a defective compressor bleed valve or anti-icing valve, leaking scroll-to-rear diffuser or compressor discharge air tube seals, or a dirty compressor. REMOVAL OF THE COMPRESSOR CASE HALF TO PERFORM ROUTINE PERIODIC INSPECTIONS IS NOT PERMITTED.

CAUTION

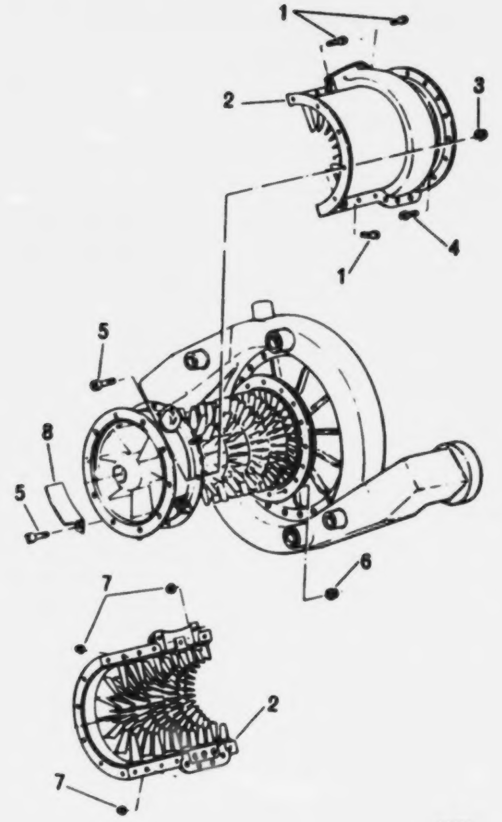
Remove only one case half at a time. DO NOT remove both case halves at the same time. Ensure that the removed case half is properly reinstalled and that the bolts are tightened to the required torque values before any of the bolts on the other case half are loosened. Misalignment of the compressor could result if both case halves were removed simultaneously. (Refer to paragraph 8-2.)

a. Remove the compressor bleed valve. (Refer to paragraph 5-33.)

b. Remove the anti-icing air tubes (23, 26, figure 5-13) between the anti-icing air valve and the compressor front support.

c. Mark the location of nameplate (8, figure 6-1) when the applicable compressor case half-to-front support bolts (5) are to be removed. This is to ensure that the nameplate will be returned to the same location at assembly.

d. Remove one compressor case half (2) by removing 16 horizontal splitline nuts (7) and bolts (1), five case half-to-front support nuts (3) and bolts (5), and eight case half-to-front diffuser nuts (6) and bolts (4). Lift the case half straight out.


1
2
3
4
1
5
8
5
6
7
2
7
14459

1. Bolt (16)
2. Compressor case half
3. Nut (10)
4. Bolt (16)
5. Bolt (10)
6. Nut (16)
7. Nut (16)
8. Nameplate

Figure 6-1. Compressor Case Assembly

CHAPTER 7

CLEANING, INSPECTION AND REPAIR

Section I. CLEANING

7-1. General

Use care in separating metals for cleaning. Observe the following general cleaning precautions.

WARNING

Petroleum solvent vapors are toxic. Provide adequate ventilation for personnel using it.

a. Petroleum solvent (item 3, tble 2-2) is the cleaning solvent recommended for nonferrous parts (Cleaners for steel will damage nonferrous parts.) Do not use rust preventives on magnesium and aluminum parts.

b. Clean aluminum-coated steel parts with carbon removal compound (item 17, table 2-2). Rinse the part with water and dry with an air blast.

c. Clean steel parts with cresol base cleaning compound (item 18, table 2-2). Rinse the part thoroughly with hot water. Coat parts with a compound of one part rust preventive (item 19, table 2-2) and three parts oil (item 20, table 2-2).

7-2. Cleaning Engine Exterior Surfaces.

Flush or spray wash external surfaces with petroleum solvent (item 3A, table 2-2) to remove grease, oil, and dirt. Ensure that all openings are plugged or covered before cleaning.

CAUTION

Engine thermocouples should never be saturated or sprayed with cleaning solvents. Liquid cleaning solvents will penetrate the porous magnesium oxide insulation. Engine heat will vaporize the solvents leaving a residue containing carbon which causes a low resistance to ground.

7-3. Compressor Cleaning to Restore Lost Performance.

CAUTION

Allow the engine to cool for a minimum of 45 minutes prior to spraying the compressor. Mandatory cooling period is required to prevent warpage to internal engine components.

Buildup of dirt in the compressor can result in a serious loss of engine power and performance. Lost performance may be restored by flushing the installed engine with a water/solvent solution as follows:

WARNING

Methanol is flammable; it should not be used if the ambient temperature is above 4°C (40°F), its vapor is harmful; it could be fatal or cause blindness if swallowed. Keep it away from open flame and avoid prolonged breathing of the vapor.

NOTE

Once the cleaning procedure is started, it must be carried through to completion without delay. At ambient temperatures below 4°C (40°F) and above -29°C (-20°F), use a 40 percent Methanol (Item 34, table 2-2), 60 percent water mixture, in place of fresh water. The temperature of the wash solution should not be below 4°C (40°F), ideally it should be between 21-26°C (70-80°F). To avoid spraying concentrated Methanol, which is combustible, mix the solution thoroughly.

a. Prepare two to four quarts of cleaning solution consisting of one part cleaning compound (item 21, table 2-2) to four parts of clean water (distilled if available).

CAUTION

Do not substitute petroleum base solvent or jet fuels for recommended cleaning compound. Damage to compressor plastic lining could result.

b. Retain the anti-icing air valve in the closed position.

c. Disconnect the control air and compressor bleed valve pressure sensing tubes at the diffuser scroll pressure probes. Cap both pressure probes and plug all open sensing lines. Block the compressor bleed valve in the closed position using the compressor protector cleaning kit, tool No. 6886204. (See figure 2-4.) Refer to TM 55-1520-228-23 for airframe bleed air operated systems.

d. Remove the burner drain valve (14, figure 3-8) from the bottom drain port on the outer combustion case.

e. Deactivate the ignition system by disconnecting the power lead to the ignition exciter.

CAUTION

Do not exceed 10% N1 motoring speed during the cleaning and rinsing cycles. Do not inject a solid stream of fluid into the compressor. Damage to compressor vanes could result.

f. Spray cleaning solution into the compressor inlet using a low pressure type sprayer equipped with a quick opening valve while motoring the engine without ignition. Start injection simultaneously with starter engagement and inject the solution at the rate of one quart in 9 to 11 seconds until 2 to 4 quarts have been utilized. Maintain motoring speed below 10% for the duration of the injection. Disengage the starter if 10% N1 speed is attained. Repeat the injection cycle as necessary until the compressor is clean.

g. Within 15 minutes after injection of the cleaning solution, spray clean water (distilled preferred) into the compressor. Use Methanol water mixture if ambient temperature is below 4°C (40°F). Start injection simultaneously with starter engagement and inject the steam or water at the rate of one pint to one quart in 5 to 10 seconds. Disengage the starter before N1 speed accelerates above 10%.

h. Remove the compressor protector cleaning kit and reconnect the control and compressor bleed valve sensing tubes. Tighten the coupling nuts to 80-120 in. lb.

i. Reconnect the power lead to the ignition exciter or reset the IGN ENG circuit breaker.

j. Apply antiseize compound (item 15, table 2-2) to the threads and install burner drain valve (14, figure 3-8) with new preformed packing (13) in the bottom drain port of the outer combustion case. Tighten the drain valve to 120-140 in. lb. Apply antiseize compound (item 15, table 2-2) to the threads on the outer end of the drain valve. Secure clamp and bracket assembly (15) to the drain valve with jam nut (16). Tighten the jam nut to 55-80 in. lb. and secure with lockwire (item 32, table 2-2).

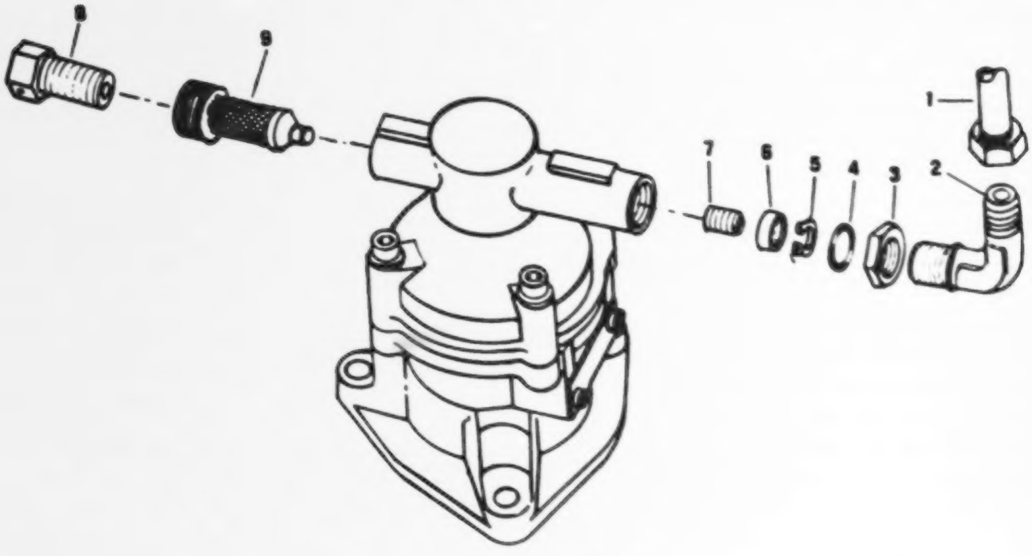
k. Start and operate the engine for a minimum of five minutes. Operate the engine anti-icing system to purge solution from the compressor front support. Also, operate any aircraft systems which use compressor bleed air. Complete the engine drying run within 15 minutes after cleaning and rinsing.

7-4. Compressor Rinsing to Remove Salt Water Contamination.

All engines operated within 10 miles of salt water shall undergo water rinsing after shutdown following the last flight of the day. Use the procedure in paragraph 7-3 with the following additions:

a. Use only clean water for rinsing solution.

b. Block the compressor bleed valve in the closed position using the compressor cleaning kit, tool no. 6886204. It is not necessary to remove any lines.



1. Air Sensing Tube
2. Elbow
3. Jam Nut
4. Preformed Packing
5. Internal Retaining Ring
6. Filter
7. Jet
8. Nozzle
9. Strainer

Figure 7-1. Compressor Bleed Valve Jet and Nozzle Removal

7-5. Cleaning Compressor Case Half.

CAUTION

Do not immerse the compressor case half in liquid cleaning solvents. Damage to the compressor plastic lining could result.

a. Place the compressor case half on end and spray with solvent (item 3, table 2-2). Blow dry immediately with clean, compressed air.

b. If there is any contamination remaining on the vanes, clean with a tooth brush and a solution consisting of one part cleaning compound (item 21, table 2-2) to four parts clean water (distilled if available). Flush with clean water and blow dry immediately with clean compressed air.

7-6. Cleaning Compressor Rotor Blades.

a. With one compressor case half removed, clean contamination from the blades using a tooth brush and a solution of one part cleaning compound (item 21, table 2-2) to four parts of clean water (distilled if possible).

b. Flush with clean water and blow dry with clean compressed air.

7-7. Compressor Bleed Valve Cleaning.

a. Remove the air sensing line (1, figure 7-1) from the compressor bleed valve elbow (2).

b. Remove the elbow from the bleed valve. Discard preformed packing (1).

c. Remove internal retaining ring (5) and separate filter (6) from the compressor bleed valve. Replace the retaining ring before assembly if it is damaged during the removal operation.

d. Using a screwdriver, remove jet (7) from the compressor bleed valve.

e. Clip the lockwire, then remove nozzle (8) and strainer (9) from the compressor bleed valve.

f. Clean the nozzle, filter, strainer, and jet ultrasonically if equipment is available. If ultrasonic equipment is not available, agitate the parts in a clean container of solvent (item 3, table 2-2). Use a soft bristle brush to lean exposed surfaces. Insert a sewing thread through the jet hole. Slide the jet back and forth on the thread to remove film. Clean the nozzle in the same manner.

CAUTION

Do not blow the jet dry. The small jet can be easily lost or damaged.

NOTE

If the jet must be replaced, return the compressor bleed valve to overhaul for part replacement and recalibration of the valve assembly.

g. Inspect the jet and the nozzle using a flashlight. Place the part on the center of the lens so the light can be seen through the hole. Reclean the part if any particles or coating can be seen.

CAUTION

Do not use a probe to remove particles lodged in the jet or nozzle. Damage to the jet or nozzle could result.

h. Install jet (7) in the compressor bleed valve. Tighten to 8-12 in. lb.

i. Place filter (6) in the compressor bleed valve (skirt end first). Secure with internal retaining ring (5).

j. Install strainer (9) and nozzle (8) in the compressor bleed valve. Tighten to 50-60 in. lb and secure with lockwire (item 10, table 2-2).

k. Lubricate preformed packing (4) with oil (item 7, table 2-2) and install it with elbow (2) on the compressor bleed valve. Do not tighten the elbow jam nut (3) at this time.

l. Position the elbow as required and install air sensing line (1). Tighten the coupling nut to 80-120 in. lb. Tighten elbow jam nut (3) to 55-80 in. lb.

Section II. INSPECTION

7-8. .Scope.

This section provides instructions for complete inspection of engine parts within the scope of the Maintenance Allocation Chart. Service limits and standards are presented to determine when parts should be repaired or replaced.

7-9. Compressor Rotor and Blade Inspection.

Visually inspect the compressor rotor and blades for the following conditions. Replace the engine if any of the limits are exceeded.

NOTE

This inspection requires removal of a compressor case half and shall be performed only for the reasons stated in paragraph 6-2.

It is not possible to fully describe all of the damage conditions that could be incurred; therefore, if damage is within rework limits, but there is reasonable doubt about the strength of the reworked blade as compared to a new blade, replace the engine. Unlimited light polishing to remove minor nicks, where blade dimensions are basically unchanged, is permissible on any part of the blade.

Blend and polish blades or vanes in a longitudinal direction only with the rework forming a smooth blend with the basic airfoil. The number of blades or vanes which may be reworked is not limited. The limiting factor of blade or vane rework is engine performance. Any reduction of blade or vane area will decrease the efficiency of the compressor and the performance of the engine. Remove as little material as possible. No sharp edges, burrs, cracks or tears are acceptable.

a. Inspect for cracked or missing compressor blades—none are permitted.

b. Inspect the compressor rotor blades and wheel hubs for evidence of corrosion. Corrosion must be removed by blending and polishing. (Refer to paragraph 7-24.) Replace the engine if pitting in any area of the blade forms a definite line or pitting exceeds the blend limits.

c. Inspect the compressor rotor blades and wheel hubs for nicks, dents and scratches in areas other than the blade leading and trailing edges. All damage and imperfections must be blended out. (Refer to paragraph 7-24*c* and *d*.) Blended areas must not exceed the limits shown on figure 7-12.

d. **Inspect for nicks, dents, and erosion on the blade leading and trailing edges and at the blade tip. All damage and imperfections must be blended out. (Refer to paragraph 7-24*a* and *b*.) Blended leading and trailing edges and chamfered blade tips must not exceed the limits shown on figures 7-10 and 7-11.**

e. **Inspect the blade tips and leading edges for evidence of loose plastic rub on all blades in a given stage. Loose plastic rub is a result of the compressor case plastic lining coming loose and displacing inward, wearing away portions of all blades in a given stage. Loose plastic rub is evidenced as a chamfer at the leading edge tip or an undercut of the blade leading edge. (See figure 7-2.) Replace the engine if rub is indicated.**

f. **Inspect the blade tips for heat discoloration on one or more blades. Heat discoloration is caused by severe blade rub on the compressor case plastic lining which occurs when the wheels shift off center due to an unbalance condition. Replace the engine if heat discoloration is detected.**

7-10. Compressor Stator Vane Inspection.

Visually inspect the compressor stator vanes for the following conditions. Replace both compressor case halves if any of the limits are exceeded.

NOTE

This inspection requires removal of a compressor case half and shall be performed only for the reasons stated in paragraph 6-2.

a. Inspect for cracked or missing stator vanes —none are permitted.

b. Inspect the vane tips for evidence of rub. Rub is indicated by smeared metal on the vane tip associated with a burr on the convex side or by heat discoloration on the vane. Replace the engine if rub is indicated.

c. Inspect for evidence of corrosion on the vanes. Pitting in any area of the vane that forms a definite line is not acceptable. Replace the compressor case if pitting exceeds blend limits. (Refer to paragraph 7-25*a*.)

d. Inspect for erosion on the airfoil leading and trailing edges. Replace the compressor case if the limits of figure 7-3 are exceeded.

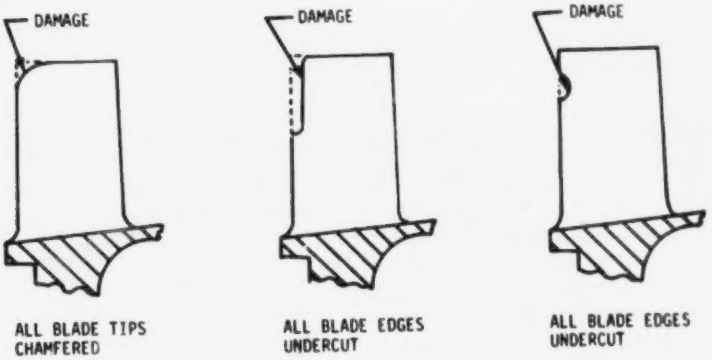
e. Inspect for nicks, and dents on the vane leading and trailing edges. All damage and inperfections must be blended out. (Refer to paragraph 7-25*a*.) Blended leading and trailing edges must not exceed the limits shown on figure 7-13.

f. Inspect for nicks and dents on the vane airfoil surface. All damage and imperfections must be blended out. (Refer to paragraph 7-25*a*.) Blended areas must be within the limits shown on figure 7-13.

g. Inspect for bent vanes. Straighten vanes that are bent on the inner three-fourths of the vane. Vanes that are bent on the outer one-fourth are not acceptable.

7-11. Compressor Plastic Coating Inspection.

Visually inspect the compressor case plastic coating for the following conditions. Replace both

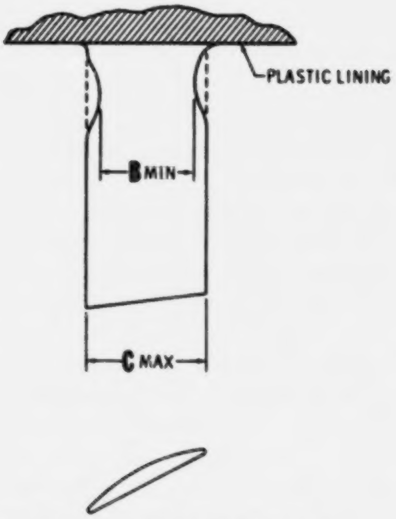


ALL BLADE TIPS CHAMFERED

ALL BLADE EDGES UNDERCUT

ALL BLADE EDGES UNDERCUT

Figure 7-2. Compressor Blade Damage Caused by Rub



STAGES 1, 2, AND 3 (B MIN) SHALL NOT BE LESS THAN (C MAX) MINUS 0.030

STAGES 4, 5, AND 6 (B MIN) SHALL NOT BE LESS THAN (C MAX) MINUS 0.060

NOTE: VANES ERODED TO ALLOWED LIMITS CAN RESULT IN SIGNIFICANT REDUCTION IN OVERALL ENGINE PERFORMANCE.

12322X

Figure 7-3. Compressor Vane Erosion

compressor case halves if any of the limits are exceeded.

NOTE

This inspection requires removal of a compressor case half and shall be performed only for the reasons stated in paragraph 6-2.

a. Cracks are acceptable without limitation as to length, quantities, or areas provided the plastic is securely bonded to the case.

b. Debonded, missing, or loose plastic in the vane row areas only is acceptable. Any raised plastic in the vane row areas shall be removed.

c. Raised or debonded plastic in the blade path areas is not acceptable. Circumferential cracks at the front or rear of the blade path can cause an arc segment of the plastic to raise when at normal operating temperatures and cause plastic wear in line with the leading or trailing edge of the blade tips. A groove worn in the plastic adjacent to a circumferential crack is evidence of debonding in the blade path.

d. Erosion of the plastic coating is acceptable unless more than one-third (60 degrees) of any single half-case vane band can be seen.

7-12. Compressor Front Support Inspection.

Visually inspect the compressor front support. Replace the engine if any of the following conditions are found.

a. Any cracks in the parent metal or braze joints.

b. Dents exceeding 1/16 in. deep.

c. Weld failures at the trailing edge spacers, as viewed from the rear with the compressor case half removed.

d. Vane erosion to the extent that reduction of skin thickness is apparent and/or trailing edge slots are restricted.

7-13. Diffuser Scroll Inspection.

Visually inspect the installed diffuser scroll for the following conditions. Replace the engine if the damage cannot be repaired.

a. Inspect for visible cracks. Replace the engine if cracks are found.

NOTE

The turning vanes and air tube inserts may be inspected only when the combustion section is removed.

b. Check the turning vanes in the outlet ports for evidence of damage. Damage is indicative of impeller vane tip or shroud failure. Replace the engine.

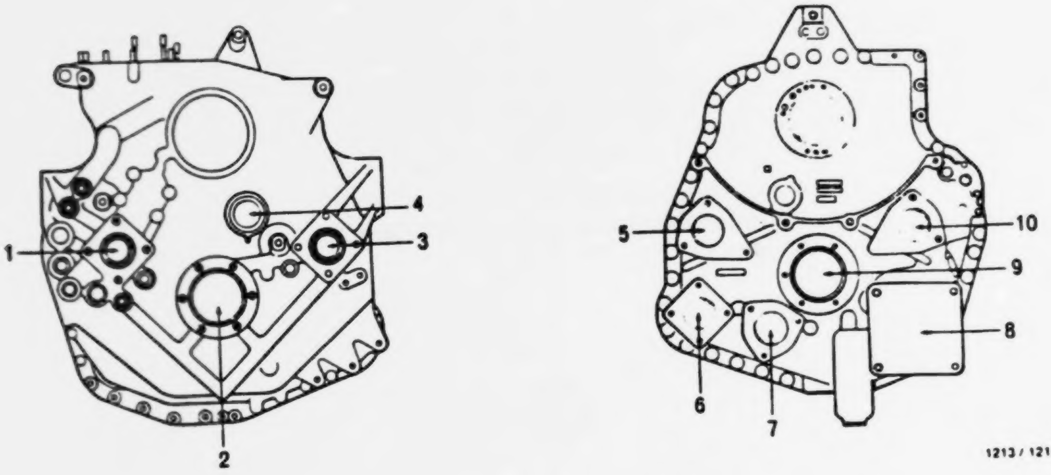
c. Inspect the diffuser scroll discharge air tube inserts for wear and looseness. If wear in the ID of the insert exceeds 0.010 in. depth or there is evidence that the insert has been pulled out of the scroll, replace the engine.

7-14. Gearbox Inspection.

Visually inspect the exterior of the gearbox for the following conditions.

a. Check for cracks in the gearbox housing and cover, especially in stress areas; engine mounts, accessory pads, and at the splitline. If cracks are found, replace the engine.

b. Check for oil leaks. If area below seal at any accessory or power takeoff pad (figure 7-4) is dripping, replace the seal assembly. (Refer to paragraph 7-27.)



1. Gas producer tachometer-generator.
2. Power takeoff
3. Power turbine tachometer generator
4. Torquemeter spanner nut
5. Power turbine fuel governor
6. Spare (not used)
7. Fuel pump
8. Starter-generator
9. Power takeoff
10. Gas producer fuel control

Figure 7-4. Gearbox Accessory Pad Locations

c. If any gearbox-mounted accessory is removed, visually inspect the gearbox studs for security, worn areas, and damaged threads. Replace loose, damaged, or worn studs. (Refer to paragraph 7-28.)

d. Check for damaged paint surfaces. Repair damaged paint per paragraph 7-29.

7-15. Thermocouple Assembly Inspection.

When erroneous indications are suspected, ensure that the indicating system is functioning properly. Perform a TOT gage calibration check and a total TOT circuit resistance check. (Refer to TM 55-4920-244-15 and TM 55-1520-228-23.) If no discrepancies are noted, check the thermocouple system as follows. Do not remove the thermocouple assembly from the engine.

a. Visually inspect the thermocouple assembly for broken leads, loose terminals, and other visible damage.

b. Disconnect the leads from the terminal assembly mounted on the right hand side of the exhaust collector.

c. Check the internal resistance of the thermocouple harness which should be 0.5 to 0.6 ohms. If the resistance is not within limits, replace engine.

7-16. Exhaust Collector Support Inspection.

Visually inspect the exhaust collector support for cracks. Cracks are not repairable; replace the engine.

7-17. Outer Combustion Case Inspection.

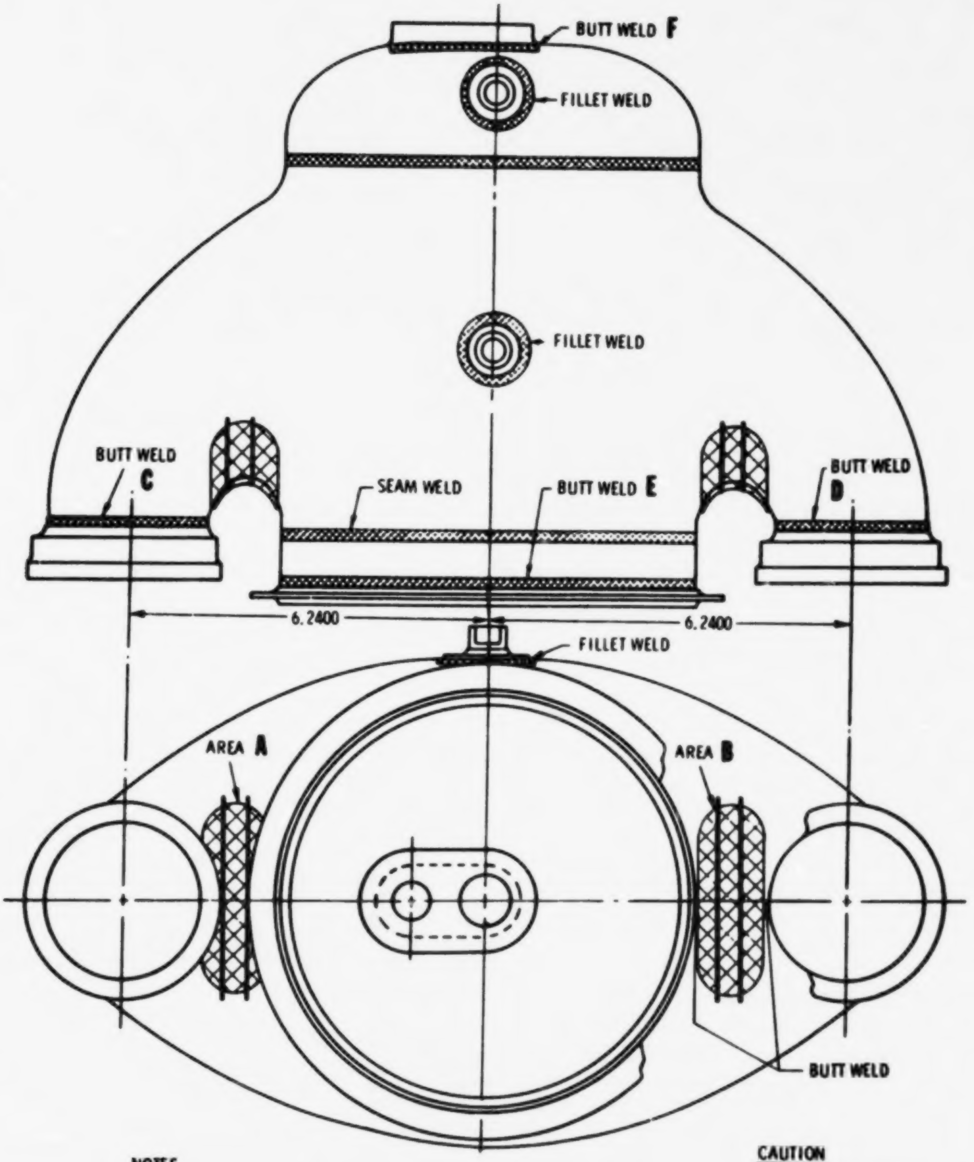
Visually inspect for cracks and dents in sheet metal surfaces and wear in the air tube bosses. Replace the outer combustion case if the repairable limits are exceeded.

a. Check for cracks in the outer shell. Replace the outer combustion case if nonrepairable cracks are found. (See figure 7-5.) Weld all repairable cracks. (Refer to paragraph 7-30.)

b. Check for cracks in the liner (inner basket). Weld repair cracks three inches or less in length and a minimum of one inch apart. (Refer to paragraph 7-30.) Replace the outer combustion case if cracks are greater than three inches in length, cracks are less than one inch apart, or there are more than two cracks.

c. Check for dents in the outer shell. Replace the outer combustion case if dents are more than ⅛ in. deep. (See figure 7-6.)

d. Check for wear in the air tube bosses. Replace the outer combustion case if wear is greater than 0.004 in. deep or out of round more than 0.004 in. (See figure 7-7.)


BUTT WELD F
FILLET WELD
FILLET WELD
BUTT WELD C
SEAM WELD
BUTT WELD E
BUTT WELD D
6.2400
6.2400
FILLET WELD
AREA A
AREA B
BUTT WELD

NOTES
WELD REPAIR NOT PERMITTED:

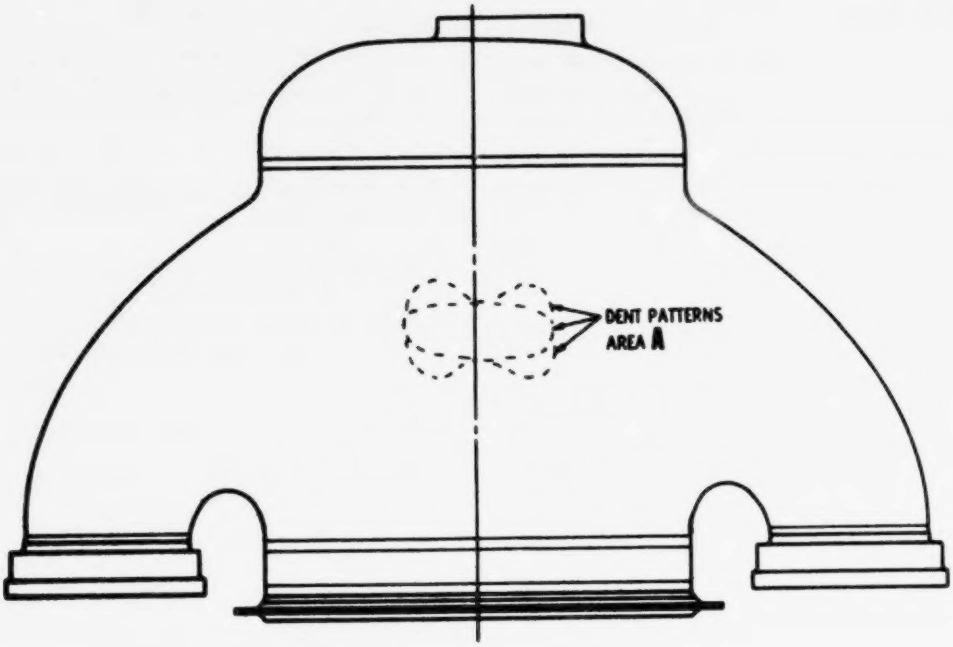
1. IF WITHIN 1/4 IN. OF AREAS **A** AND **B**.
2. IF WITHIN 1/4 IN. OF BUTT WELD IN AREAS **A** AND **B**.
3. IF WITHIN 1/4 IN. OF BUTT WELD **C** AND **D**.
4. IF WITHIN ORIGINAL FLANGE BUTT WELDS AND LARGER THAN REQUIRED TO REPAIR A PIN HOLE LEAK.
5. IF IN FLANGE MATERIAL. (SEE NOTE 4.)

CAUTION

ARC STRIKES WITHIN AREAS DEFINED BY NOTES 2 AND 3 ARE NOT ACCEPTABLE NOR REPAIRABLE.

14487

Figure 7-5. Outer Combustion Case Inspection

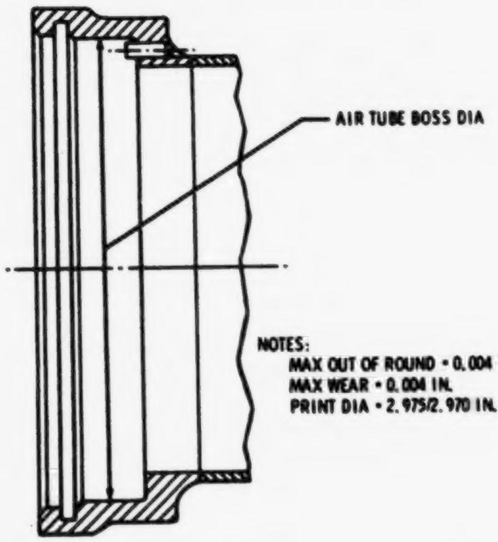

DENT PATTERNS
AREA A

MAX DENT LIMIT

AREA A ONE DENT, 1 IN. x 3 IN. x 1/8 IN. DEPTH

6U76A

Figure 7-6. Dent Limits—Top of Outer Combustion Case


AIR TUBE BOSS DIA

NOTES:
MAX OUT OF ROUND = 0.004 IN.
MAX WEAR = 0.004 IN.
PRINT DIA = 2.975/2.970 IN.

11150

Figure 7-7. Outer Combustion Case Air Tube Boss

7-18. Compressor Discharge Air Tubes Inspection.

Visually inspect for cracks or dents in the sheet metal surfaces and wear in the seal ring grooves. Replace the air tube if repairable limits are exceeded.

a. Check for cracks in the sheet metal surface. Weld repair cracks which are three inches or less in length and do not extend into the brazed joints at the end flanges. (Refer to paragraph 7-31.) Replace the air tube if cracks are longer than three inches or extend into the brazed joint.

b. Check for dents in the sheet metal surfaces. Replace the air tube if:

(1) Any dent is greater than ⅛ in. deep.

(2) There are more than four dents up to ⅛ in. deep in areas not affected by weld joints.

(3) Any dent is greater than 1½ in. in diameter.

NOTE

Dents should be round with no evidence of a sharp bottom. As a rule of thumb, a dent ⅛ in. deep should be a minimum of ½ inch in diameter.

7-19. Compressor Discharge Air Tube Seal Ring Inspection.

Replace compressor discharge air tube seal rings which exhibit fretting, excessive wear, or distortion. Replace two-piece seals when the spherical radius on the OD is worn flat all the way across.

7-20. Combustion Liner Inspection.

Inspect the combustion liner as outlined in table 7-1.

Table 7-1. Combustion Liner Inspection

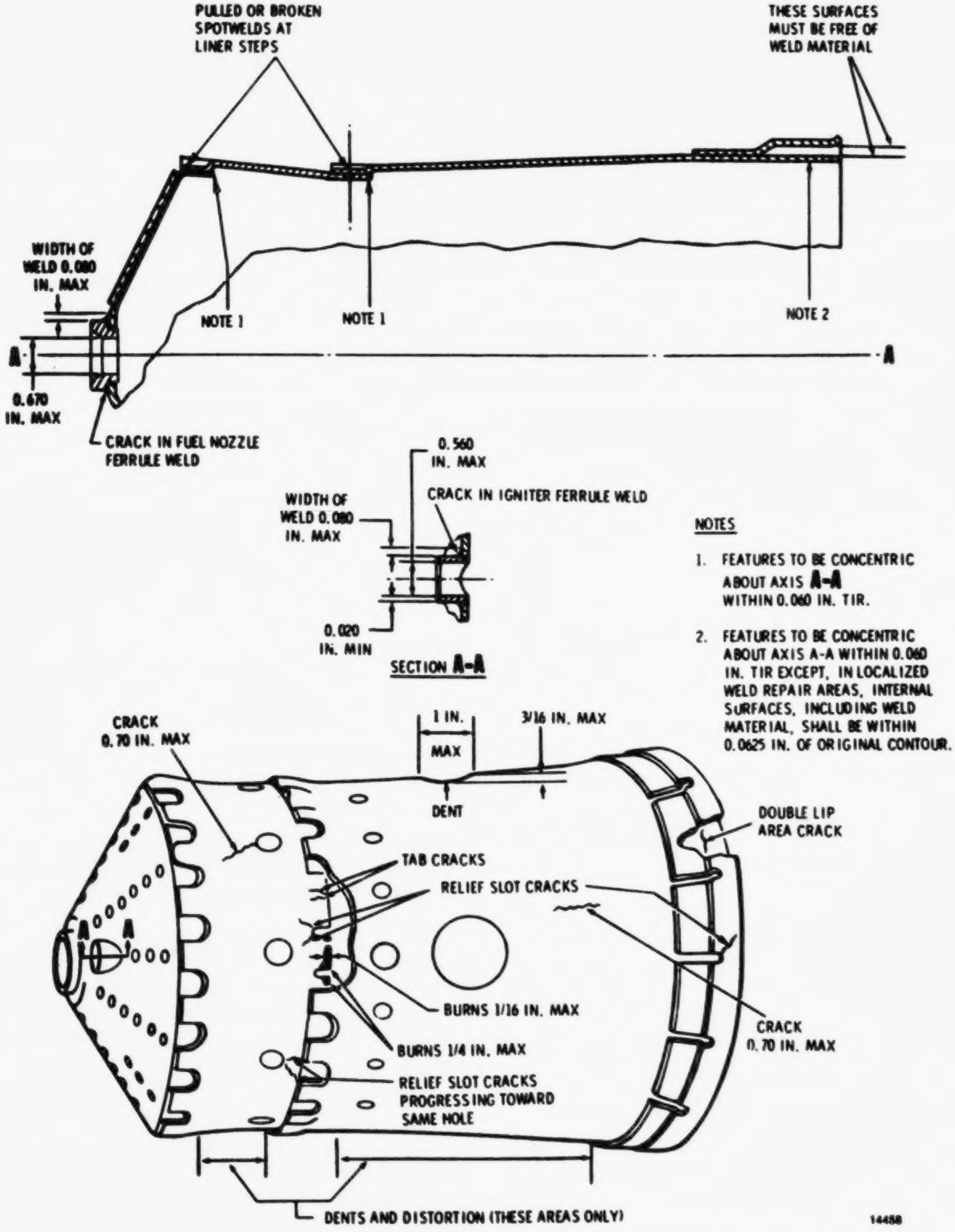
Item	Inspection and method	Serviceable limits	Repairable limits	Corrective action
1	Pulled or broken spotwelds at liner step. (See fig. 7-8.) (Visual)	None permitted.	Not more than four adjacent spotwelds or 40 percent of total per step.	Weld repair. (Refer to paragraph 7-32a.)
2	Handling damage. (See fig. 7-8.)			
	a. Mashed-out-of-round. (Visual)	None permitted.	Able to straighten to concentricity limits.	Straighten and re-form.
	b. Dented. (Visual)	None permitted.	Any dent that remains within the area shown on figure 7-8 and does not cause thin-out of metal. Straightened dents must meet concentricity limits.	Straighten and re-form.
3	Localized high temperature distortion indicated by warping or rippling of the liner surface and is normally accompanied by discoloring (burning) of the area. (Visual)	Warpage less than 3/16 in. deep over an area 1 in. in diameter and remaining within the area shown on figure 7-8.	Not repairable.	Replace liner.

Table 7-1. Combustion Liner Inspection (Continued)

Item	Inspection and method	Serviceable limits	Repairable limits	Corrective action
4	Burning in area of relief slots. (See fig. 7-8.) (Visual)	Rear edge burned less than 1/16 in. or both corners burned less than 1/4 in. along relief slot.	Not repairable.	Replace liner.
5	Crack on outside of liner. (See fig. 7-8.) (Visual)	None permitted.	Any number as long as crack length does not exceed limits shown on figure 7-8. Not repairable if crack cannot be completely welded and/or weld obstructs cooling air passage.	Weld repair. (Refer to paragraph 7-32b.)
6	Crack in tab end inside liner. (See fig. 7-8.) (Visual)	No cracks greater than 1/4 in. long and no more than two cracks per tab.	Not repairable.	Replace liner.
7	Cracks at two adjacent relief slots progressing toward same hole. (See fig. 7-8.) (Visual)	Not permitted.	Not repairable.	Replace liner.
8	Crack in relief slots at combustion liner steps. (See fig. 7-8.) (Visual)	Any number 3/16 in. or less in length.	Any number 1/2 in. or less in length.	Weld repair. (Refer to paragraph 7-32b.)
9	Crack in double lip area. (See fig. 7-8.) (Visual)	None permitted.	Not more than 3 in. long.	Weld repair. (Refer to paragraph 7-32b.)
10	Crack in igniter ferrule attaching weld. (See fig. 7-8.) (Visual)	None permitted.	Crack does not exceed 1/4 in. long.	Weld repair. (Refer to paragraph 7-32c.)
11	Roughened igniter ferrule ID. (See fig. 7-8.) (Visual)	None permitted.	ID does not exceed 0.560 in. after polishing.	Polish ID. (Refer to paragraph 7-32d.)
12	Worn or distorted (out-of-round) igniter ferrule. (See fig. 7-8.) (Visual)	Wall thickness is not less than 0.020 in. and/or ID does not exceed 0.560 in.	Not repairable.	Replace liner.
13	Crack in fuel nozzle ferrule attaching weld. (See fig. 7-8.) (Visual)	None permitted.	Crack does not exceed 1/4 in. long.	Weld repair. (Refer to paragraph 7-32c.)

Table 7-1. Combustion Liner Inspection (Continued)

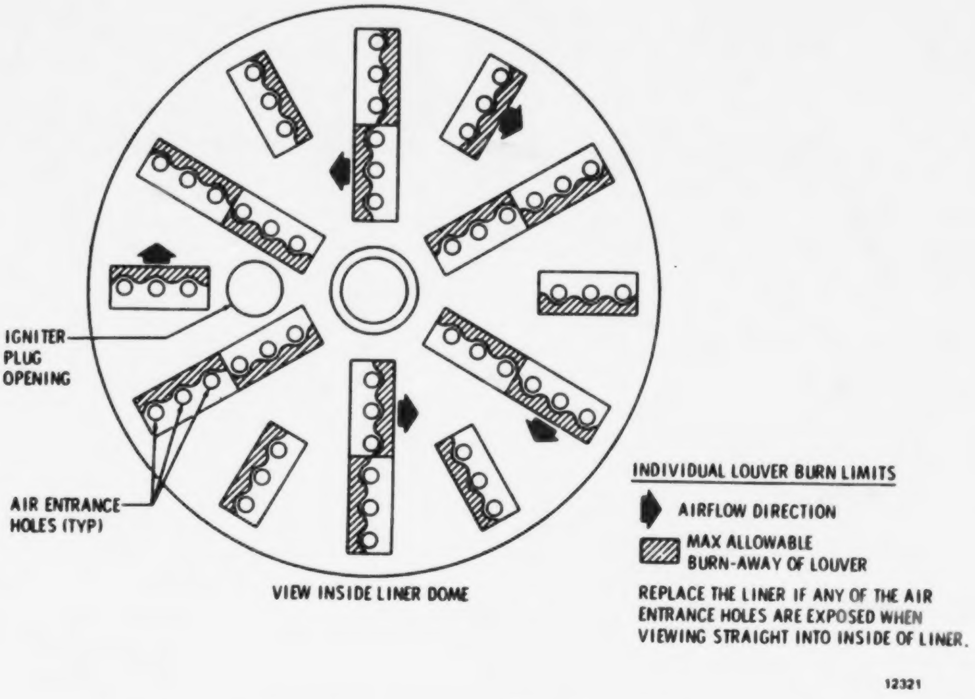
Item	Inspection and method	Serviceable limits	Repairable limits	Corrective action
14	Roughened fuel nozzle ferrule ID. (See fig. 7-8.) (Visual)	None permitted.	ID does not exceed 0.670 in. after polishing.	Polish ID. (Refer to paragraph 7-32d.)
15	Worn or distorted (out-of-round) fuel nozzle ferrule. (See fig. 7-8.) (Visual)	ID does not exceed 0.670 in.	Not repairable.	Replace liner.
16	Dome louvers bent closed or restricted by carbon. (Visual)	0.060-0.065 in. uniform opening.	Not applicable.	Lightly wire brush to remove carbon. Reposition louvers by bending to proper opening.
17	Burned louvers. (See fig. 7-9.) (Visual)	Does not exceed limits of fig. 7-9.	Not repairable.	Replace liner.


PULLED OR BROKEN SPOTWELDS AT LINER STEPS
THESE SURFACES MUST BE FREE OF WELD MATERIAL
WIDTH OF WELD 0.080 IN. MAX
NOTE 1
NOTE 1
NOTE 2
A
A
0.670 IN. MAX
CRACK IN FUEL NOZZLE FERRULE WELD
0.560 IN. MAX
CRACK IN IGNITER FERRULE WELD
WIDTH OF WELD 0.080 IN. MAX
0.020 IN. MIN
SECTION A-A
CRACK 0.70 IN. MAX
1 IN. MAX
3/16 IN. MAX
DENT
DOUBLE LIP AREA CRACK
TAB CRACKS
RELIEF SLOT CRACKS
A
A
BURNS 1/16 IN. MAX
BURNS 1/4 IN. MAX
CRACK 0.70 IN. MAX
RELIEF SLOT CRACKS PROGRESSING TOWARD SAME HOLE
DENTS AND DISTORTION (THESE AREAS ONLY)
14458

NOTES

1. FEATURES TO BE CONCENTRIC ABOUT AXIS **A-A** WITHIN 0.060 IN. TIR.
2. FEATURES TO BE CONCENTRIC ABOUT AXIS A-A WITHIN 0.060 IN. TIR EXCEPT, IN LOCALIZED WELD REPAIR AREAS, INTERNAL SURFACES, INCLUDING WELD MATERIAL, SHALL BE WITHIN 0.0625 IN. OF ORIGINAL CONTOUR.

Figure 7-8. Combustion Liner Inspection


IGNITER PLUG OPENING
AIR ENTRANCE HOLES (TYP)
VIEW INSIDE LINER DOME
12321

INDIVIDUAL LOUVER BURN LIMITS

➡ AIRFLOW DIRECTION

▨ MAX ALLOWABLE BURN-AWAY OF LOUVER

REPLACE THE LINER IF ANY OF THE AIR ENTRANCE HOLES ARE EXPOSED WHEN VIEWING STRAIGHT INTO INSIDE OF LINER.

Figure 7-9. Inspection of Combustion Liner Dome Louvers

7-21. Turbine First-stage Blades Inspection.

Inspect the N1 turbine first-stage blades whenever a turbine overtemperature inspection is performed. (Refer to paragraph 12-2.)

7-22. Turbine First-stage Nozzle and Shield Inspection.

Inspect the turbine first-stage nozzle and shield whenever a turbine overtemperature inspection is performed. (Refer to paragraph 12-2.)

Section III. REPAIR

7-23. Scope.

This section provides instructions for accomplishing complete and detailed maintenance on the engine within the scope of the Maintenance Allocation Chart. Each subassembly or part is treated as a separate unit in the discussion of repair procedures.

7-24. Compressor Rotor and Blades.

Repair of the compressor rotor and blades consists of blending and polishing to remove nicks, dents, scratches, corrosion, or erosion from the blades, blade fillets and wheel hubs. Where blending is recommended, use a No. 0 Swiss pattern file or a medium grit stone. Where polishing is recommended, use a fine grit stone or abrasive paper (item 22, table 2-2). Blend and polish blades in a longitudinal direction only with the repair forming a smooth blend with the basic airfoil. No sharp edges, burrs, cracks, or tears are acceptable after blending. The number of blades or vanes which may be reworked is not limited. The limiting factor of blade or vane rework is engine performance. Any reduction of blade or vane area will decrease the efficiency of the compressor and the performance of the engine. Remove as little material as possible.

a. Leading and Trailing Edge Damage. Blend and polish to remove damage on the outer ⅔ of the blade. Replace engine when: (1) the limits of figure 7-10 are exceeded or (2) there is edge damage in the lower ⅓ that cannot be removed by light polishing.

b. Tip Damage. Blend and polish to remove tip damage. Replace engine when: (1) more than ⅓ (⅙ on each side) of the original blade width requires rework or (2) rework extends within the inner ⅘ of the blade length. (See figure 7-11.)

c. Surface Damage. Blend and polish to remove surface damage. Replace the engine when any of the limits of figure 7-12 are exceeded.

d. Corrosion. Blend and polish to remove all corrosion caused pits by blending to limits defined for damage. Replace the engine when: (1) pitting in any area of the blade forms a definite line or (2) pit size or location exceeds blend limits. (See figure 7-10, 7-11, and 7-12.)

e. Erosion. Replace the engine when erosion of a blade tip results in a blade chord width less than the acceptable chord blend limits. (See figure 7-12.)

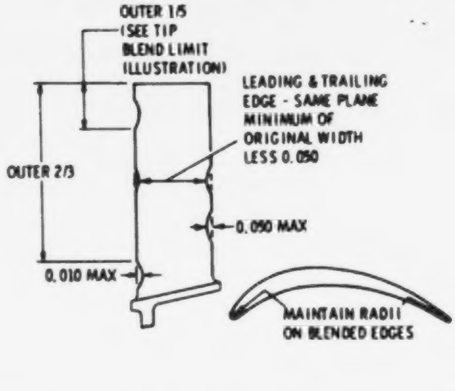

OUTER 1/5 (SEE TIP BLEND LIMIT ILLUSTRATION)
LEADING & TRAILING EDGE - SAME PLANE MINIMUM OF ORIGINAL WIDTH LESS 0.050
OUTER 2/3
0.050 MAX
0.010 MAX
MAINTAIN RADII ON BLENDED EDGES
14482

Figure 7-10. Compressor Rotor Blade Leading and Trailing Edge Blend Limits

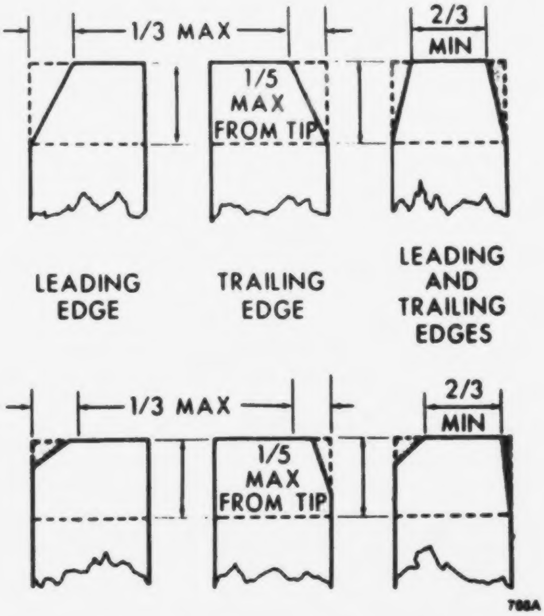
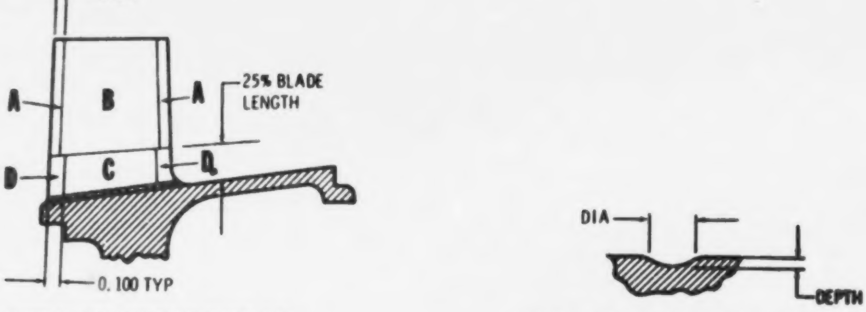

1/3 MAX
2/3 MIN
1/5 MAX FROM TIP
LEADING EDGE
TRAILING EDGE
LEADING AND TRAILING EDGES
1/3 MAX
2/3 MIN
1/5 MAX FROM TIP
708A

Figure 7-11. Compressor Rotor Blade Tip Blend Limits



VIEW 1. DEFINITION OF BLADE AND WHEEL SURFACES

VIEW 2. ROUND EDGE, ROUND BOTTOM IMPERFECTIONS

AREA	SURFACE BLENDING LIMIT FOR REMOVAL OF CORROSION PITS, NICKS AND DENTS
A	LEADING AND TRAILING EDGE RADII MUST BE MAINTAINED. (SEE LE AND TE BLEND LIMIT ILLUSTRATION FOR REWORK LIMIT.)
B	0.020 MAX DEPTH; BUT NOT EXCEEDING 1/3 OF BLADE THICKNESS.
C, D	ON THE CONVEX SIDE OF C AND THE CONCAVE SIDE OF D, POLISH ONLY. NO MEASUREABLE METAL REMOVAL.
C, D	ON THE CONCAVE SIDE OF C AND THE CONVEX SIDE OF D, 0.010 MAX DEPTH.

NOTE: ROUND EDGE, ROUND BOTTOM INDENTS (SEE VIEW 2) CAN OCCUR IN THE ORIGINAL AS-CAST SURFACE; THESE ARE NOT CORROSION PITS. IF THE INDENT CANNOT BE WIPED CLEAN (DARK SPOT REMAINS IN INDENT), BLEND THE INDENT AS A CORROSION PIT.

14481

Figure 7-12. Compressor Blade Surface Blending Limits

7-25. Compressor Case.

Repair of the compressor case consists of blending and polishing to remove nicks, dents, corrosion, and erosion from the stator vanes. Where blending is recommended, use a No. 0 Swiss pattern file or a medium grit stone. Where polishing is recommended, use a fine grit stone or abrasive paper (item 22, table 2-2). Blend and polish vanes in a longitudinal direction only with the repair forming a smooth blend with the basic airfoil. No sharp edges, burrs, cracks, or tears are acceptable after blending.

NOTE

It is impossible to fully describe all damage conditions that can be encountered. If damage is within the repair limits of figure 7-13 but there is reasonable doubt about the strength of the blended vanes, replace the compressor case. Unlimited light polishing to remove minor damage where vane dimensions are basically unchanged, is permissible on any part of the vane.

a. Vane Damage. Replace the compressor case if any vanes are cracked or broken off or show evidence of tip rub on the rotor spacer. Blend limits for the vanes are as follows:

(1) *Leading and Trailing Edge Damage.* Replace the compressor case if damage to the leading and trailing edge cannot be blended out without reducing the total width of the vane more than the limits given in figure 7-13. Replace the compressor case when after blending, the vane total width is reduced more than the limits given in figure 7-13 or there are sharp edges, burrs, cracks or tears after blending.

(2) *Surface Damage.* (See figure 7-13.) Blend and polish surface damage on the vanes. Replace the compressor case when: (1) the blending depth exceeds ½ of the vane thickness or (2) cracking is detected on the vane surface.

(3) *Erosion.* Replace the compressor case when vane erosion at a specified stage results in a vane chord width less than the acceptable chord width (B). (See figure 7-3.)

(4) *Corrosion.* Blend and polish to remove corrosion pitting. Replace the compressor case when pitting in any area of the vane forms a definite line or blending exceeds same limits as given for blades. (See figure 7-12.)

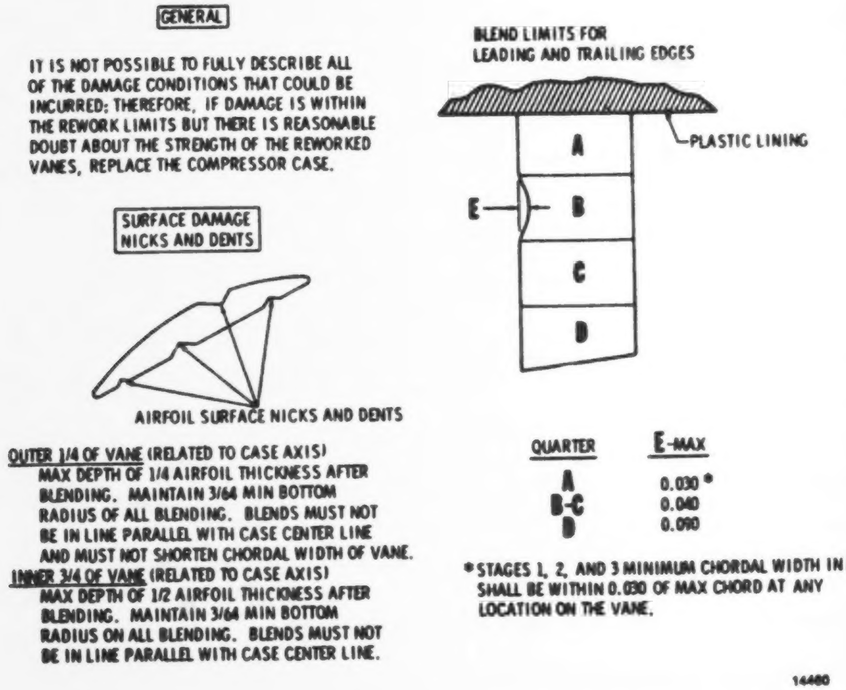
b. Compressor Case Painting. The compressor case external surface is painted with gray, corrosion resistant paint. Repair damaged paint on the external surface of the compressor case as follows:

(1) Abrade the damaged area and localized surrounding area with emery cloth (item 23, table 2-2).

(2) Wipe abraded area with paint thinner (item 24, table 2-2).

(3) Apply gray corrosion resistant paint (item 25, table 2-2) to the abraded area.

(4) Air dry at least one hour before handling.



GENERAL

IT IS NOT POSSIBLE TO FULLY DESCRIBE ALL OF THE DAMAGE CONDITIONS THAT COULD BE INCURRED; THEREFORE, IF DAMAGE IS WITHIN THE REWORK LIMITS BUT THERE IS REASONABLE DOUBT ABOUT THE STRENGTH OF THE REWORKED VANES, REPLACE THE COMPRESSOR CASE.

SURFACE DAMAGE NICKS AND DENTS

AIRFOIL SURFACE NICKS AND DENTS
BLEND LIMITS FOR LEADING AND TRAILING EDGES
PLASTIC LINING
A
B
C
D
E

OUTER 1/4 OF VANE (RELATED TO CASE AXIS)
MAX DEPTH OF 1/4 AIRFOIL THICKNESS AFTER BLENDING. MAINTAIN 3/64 MIN BOTTOM RADIUS OF ALL BLENDING. BLENDS MUST NOT BE IN LINE PARALLEL WITH CASE CENTER LINE AND MUST NOT SHORTEN CHORDAL WIDTH OF VANE.

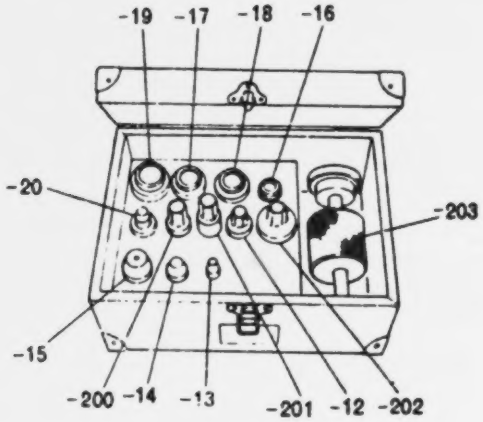
INNER 3/4 OF VANE (RELATED TO CASE AXIS)
MAX DEPTH OF 1/2 AIRFOIL THICKNESS AFTER BLENDING. MAINTAIN 3/64 MIN BOTTOM RADIUS ON ALL BLENDING. BLENDS MUST NOT BE IN LINE PARALLEL WITH CASE CENTER LINE.

QUARTER	E-MAX
A	0.030 *
B-C	0.040
D	0.090

* STAGES 1, 2, AND 3 MINIMUM CHORDAL WIDTH IN A SHALL BE WITHIN 0.030 OF MAX CHORD AT ANY LOCATION ON THE VANE.

14460

Figure 7-13. Compressor Stator Vane Blend Limits



DETAIL	NAME AND APPLICATION
6796941-200	PULLER—TACHOMETER
-201	PULLER—FUEL PUMP, ACCESSORY DRIVE, FUEL CONTROL, GOVERNOR, AND STARTER
-202	PULLER—POWER TAKEOFF
-203	HANDLE ASSEMBLY
-12	PULLER—IDLER GEARS
-13	GUIDE—TACHOMETER
-14	GUIDE—FUEL PUMP, ACCESSORY DRIVE, FUEL CONTROL, GOVERNOR, AND STARTER
-15	GUIDE—HELICAL POWER TRAIN DRIVE
-16	INSTALLATION TOOL—TACHOMETER
-17	INSTALLATION TOOL—FUEL PUMP, SPARE, FUEL CONTROL AND GOVERNOR
-18	INSTALLATION TOOL—STARTER
-19	INSTALLATION TOOL—POWER TAKEOFF
-20	INSTALLATION TOOL—GAS PRODUCER GEAR TRAIN IDLER SPUR GEAR

Figure 7-14. Seal Puller Kit

7-26. Diffuser Scroll.

WARNING

The diffuser scroll contains Magnesium Thorium (MG-TH) alloy. Maintenance is to be performed as outlined in the Nuclear Regulatory Commission Source Material License Number STB-1433 issued to USAAVSCOM.

Air Tube Insert Blend Repair. Using abrasive paper (item 30, table 2-2) blend and polish wear in the ID of the air tube inserts which does not exceed 0.010 in. depth. Blend and polish wear step as necessary to ensure freedom of movement of the air tube seals and to ensure that the sealing properties will not be impaired.

7-27. Gearbox External Seals Replacement

CAUTION

To prevent damage to the gearbox housing, do not pry between the seal cavity in the gearbox housing and the seal. Be careful not to contaminate the shaft bearing or damage the gearshaft.

a. Remove the accessory or drive from the gearbox pad.

b. Remove defective seals using seal puller kit, tool No. 6796941 as follows: (See figure 7-14.)

(1) Use-201 detail to remove seals (1, figure 7-15).

(2) Use-202 detail to remove seals (2).

(3) Use-200 detail to remove seals (3).

c. Discard removed seals.

d. Apply grease (item 14, table 2-2) to the seal lip to aid installation. Carefully drive the new seal into place using seal kit, tool No. 6796941 as follows: (See figure 7-14.)

(1) Use -17 detail to install seals (1, figure 7-15) at the fuel pump, spare accessory, fuel control, and governor pads.

(2) Use -18 detail to install seal (1) at the starter-generator pad.

(3) Use -19 detail to install seals (2) at the power takeoff pads.

(4) Use -16 detail to install seals (3) at the tachometer pads.

e. Reinstall the accessory or drive on the gearbox pad.

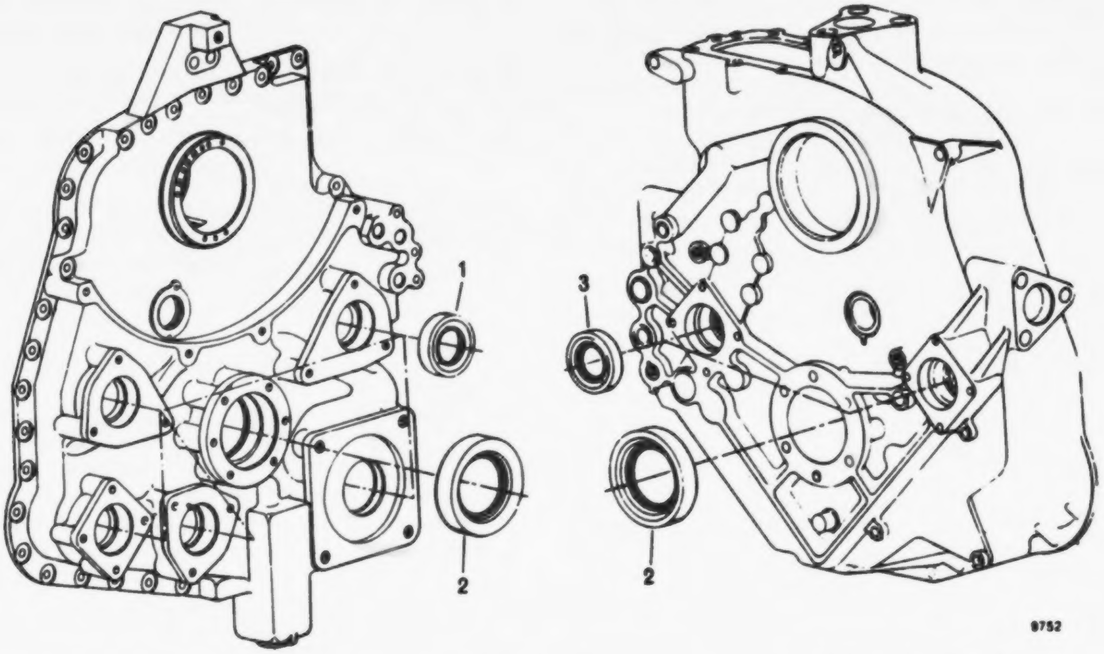
7-28. Gearbox External Stud Replacement.

a. Remove and discard damaged stud.

b. Clean and retap stud hole threads only when condition of hole threads restrains stud installation. Use the same size tap. (See figure 7-16).

c. Apply antiseize compound (item 27, table 2-2) to the stud threads and to the stud hole threads.

d. Install the stud and tighten to obtain the torque and setting height specified on figure 7-16. Oversize replacement studs may be used when necessary.



1. Accessory pad seals
2. Power takeoff pad seals
3. Tachometer pad seals

Figure 7-15. Gearbox External Seals

7-29. Gearbox Housing and Cover Painting.

Repair damaged paint on the external surfaces of the gearbox housing and cover as follows:

a. Clean the damaged area with a clean cloth saturated with solvent (item 3, table 2-2).

b. Using emery cloth (item 23, table 2-2), abrade an area slightly larger than the damaged area. Feather the edges of the abraded area.

c. Clean the area as in step *a* and dry using a blast of clean compressed air.

***d.* Chrome pickle the cleaned area per MIL-M-3171.**

e. Wipe the abraded area with paint thinner (item 24, table 2-2).

f. Apply medium gray corrosion resistant paint (item 25, table 2-2) to the abraded area.

g. Air dry at least one hour before handling. Heat may be applied with a heat lamp to speed up curing; however, do not exceed 300°F. Approximately 20 minutes will be required for the heat cure.

7-30. Outer Combustion Case Weld Repair.

Weld repair cracks in the outer combustion case as follows: (See figure 7-5.)

a. Remove surface contamination using a stainless steel wire brush.

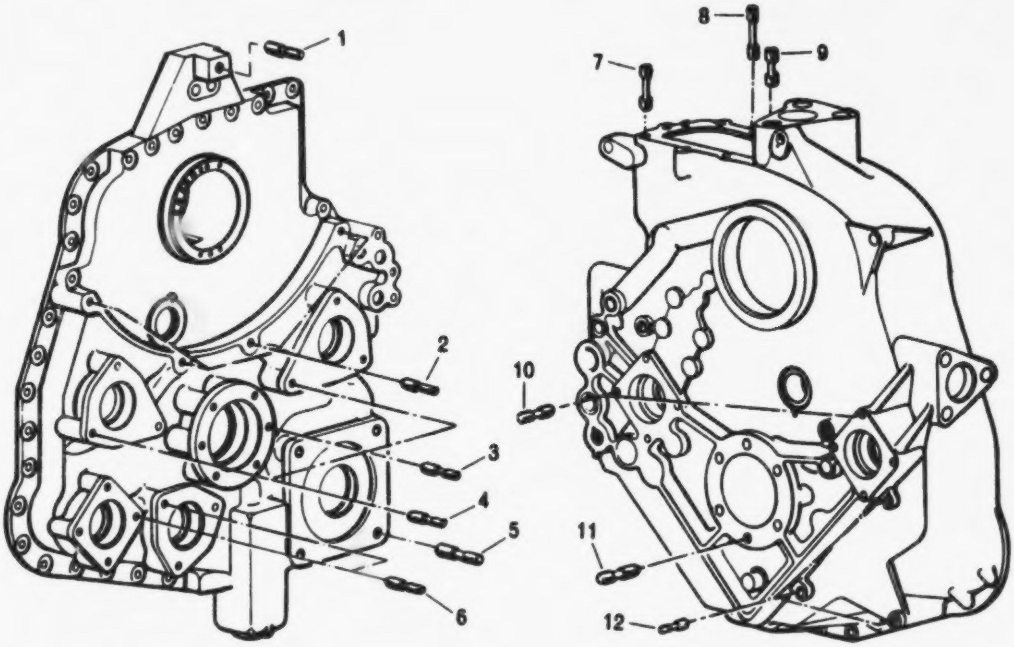
b. Clean the area with acetone (item 28, table 2-2) using a clean cloth for the application.

c. Weld cracks using inert gas arc and class 6 weld rod (item 29, table 2-2). Apply ⅛ in. wide stringer bead using medium heat input. Cool each bead with a wet cloth immediately. Do not apply another bead until cool enough to touch by hand.

d. Inspect the weld for undercut, cracking, and discontinuities. There must be not evidence of undercutting and cracking.

7-31. Compressor Discharge Air Tube Weld Repair.

Weld repair cracks in the compressor discharge air tubes as follows:



REF NO.	THREAD		SETTING TORQUE (LB IN.)	SETTING HEIGHT (IN.)
	SIZE	TYPE		
1	3/8-16	UNJC-3B	105-210	0.66-0.70
2	5/16-18	UNJC-3B	50-100	0.60-0.64
3	5/16-18	UNJC-3B	50-100	0.91-0.95
4	5/16-18	UNJC-3B	50-100	0.60-0.64
5	3/8-16	UNJC-3B	105-210	0.89-0.93
6	5/16-18	UNJC-3B	50-100	0.85-0.89
7	1/4-20	UNC-3B	20-40	0.54-0.58
8	1/4-20	UNC-3B	20-40	1.17-1.21
9	1/4-20	UNC-3B	20-40	0.79-0.83
10	5/16-18	UNC-3B	50-100	0.62-0.66
11	5/16-18	UNC-3B	50-100	0.62-0.66
12	1/4-20	UNC-3B	20-40	0.42-0.46

9739

Figure 7-16. Gearbox External Stud Data

a. Remove surface contamination using a stainless steel brush.

b. Clean the area with acetone (item 28, table 2-2) using a clean cloth for the application.

c. Weld cracks using inert gas arc and class 6 weld rod (item 29, table 2-2).

d. Do not grind weld unless weld material extends into air path. Thin-out of material from welding or grinding is not permitted.

7-32. Combustion Liner Repair.

a. Pulled or Broken Spotwelds. Weld repair pulled or broken spotwelds in the liner steps as follows: (See figure 7-8.)

(1) Drill a $\frac{3}{16}$-in. diameter hole through the outer liner section only.

(2) Remove surface contamination using a stainless steel wire brush.

(3) Clean the area with acetone (item 28, table 2-2) using a clean cloth for the application.

(4) Press the liner sections together and plugweld using inert gas arc with class 6 weld rod (item 29, table 2-2). Weld material must not extend into air openings. Do not grind the weld unless weld material blocks air entry.

b. Cracks in Liner Surface, Relief Slots, and Double Lip Area. Weld repair cracks as follows:

(1) Remove surface contamination using a stainless steel wire brush.

(2) Clean the area with acetone (item 28, table 2-2) using a clean cloth for the application.

(3) Weld cracks using inert gas arc with class 6 weld rod (item 29, table 2-2). Weld material must not obstruct cooling air passage. Do not grind weld unless weld material obstructs cooling air passage.

c. Cracks in Igniter and Fuel Nozzle Ferrule Attaching Welds. Repair cracks in the attaching (fillet) weld as follows:

(1) Remove surface contamination using a stainless steel wire brush.

(2) Clean the area with acetone (item 28, table 2-2) using a clean cloth for the application.

(3) Weld cracks using inert gas arc. Use class 6 weld rod (item 29, table 2-2) on the igniter ferrule. Use class 12 weld rod (item 29, table 2-2) on the fuel nozzle ferrule.

d. Fuel Nozzle and Igniter Ferrule ID Roughness. Remove roughened or galled surfaces in the ID of the fuel nozzle and igniter ferrules by polishing with emery cloth (item 23, table 2-2). Polish as required to remove all surface roughness. Check to ensure that the ID, after polishing, does not exceed the limit specified in table 7-1.

CHAPTER 8

ASSEMBLY OF SUBASSEMBLIES

8-1. Scope.

This chapter presents step-by-step procedures for reassembly of component parts into major functional assemblies from the level of disassembly permitted by the Maintenance Allocation Chart.

CAUTION

Use only chrome plated steel or unplated steel tools for the assembly procedures described in this manual. The use of cadmium or zinc plated tools is not permitted since these platings are prone to chipping and flaking. Should these chips enter the engine, they may contaminate the lubrication system, ultimately clogging the filters or produce intergranular attack on nickel or titanium base alloys at elevated temperatures.

8-2. Compressor Case Half Installation.

CAUTION

The compressor case halves are a matched set and shall not be intermixed. If the removed case half cannot be repaired to a serviceable condition, replace both case halves. Remove only one case half at a time. Do not remove both case halves at the same time. Misalignment of the compressor could result if both case halves were removed simultaneously.

a. Position the compressor case half in place on the compressor.

b. Install eight bolts (1, figure 6-1) and nuts (7) in each horizontal splitline. Bolts at positions two and seven are pilot bolts. Tighten nuts on the pilot bolts to 10-15 in. lb plus locknut drag; then tighten the remaining nuts.

NOTE

To determine locknut drag, run the nut up snug; then back off one-half turn. The torque required to first turn the loosened nut is locknut drag.

c. Install the eight case-to-front diffuser bolts (4) and nuts (6). Tighten the nuts to 10-15 in. lb plus locknut drag.

d. Install nameplate (8) (if applicable) and the five case-to-front support bolts (5) and nuts (3). Tighten the nuts to 10-15 in. lb plus locknut drag.

CAUTION

Do not attempt to rotate the compressor using a speed wrench at the tachometer drive pad. Side loads on the speed wrench could crack the tachometer drive shaft.

e. Turn the compressor rotor using the 6799790 engine turning adapter (figure 2-1) at the spare accessory pad (6, figure 7-4). The rotor and gear train should turn freely with no evidence of interference or blade tip rub (evidenced by feel or noise).

f. Install the compressor bleed valve. (Refer to paragraph 5-33.)

g. Install anti-icing air tubes (23, 26, figure 5-13). Tighten the coupling nuts to 150-200 in. lb.

CHAPTER 9
FINAL ENGINE ASSEMBLY

9-1. Scope.

This chapter provides instruction for installing major engine assemblies and components on the engine while it is installed in the airframe or in the 6795579 engine assembly turnover stand. (See figure 2-8.)

CAUTION

Use only chrome plated steel or unplated steel tools for the assembly procedures described in this manual. The use of cadmium or zinc plated tools is not permitted since these platings are prone to chipping and flaking. Should these chips enter the engine, they may contaminate the lubrication system, ultimately clogging the filters or produce intergranular attack on nickel or titanium base alloys at elevated temperatures.

9-2. Combustion Section Installation.

Install the combustion section on the engine while the engine is installed in the airframe or while it is installed in turnover stand, tool No. 6795579. (See figure 2-8.) If the turnover stand is used, rotate the engine in the stand to a vertical position with the compressor on the bottom.

a. Install the first stage nozzle shield (22, figure 3-8).

(1) Apply antiseize compound (item 15, table 2-2), and install two positioning plugs (21). Tighten to 100-150 in. lb. and secure with lockwire (item 10, table 2-2).

b. Place the combustion lines (3) over the first-stage turbine nozzle shield with the igniter plug opening at the nine o'clock position (as viewed from the rear of the engine).

c. Slip the retaining rings (17) over the large ends of the compressor discharge air tubes (18).

d. Apply lubricant (item 31, table 2-2) to the seal ring assemblies (19 and 20) if they do not incorporate a previously applied bonded lubricant. Install the individual components of the seal assemblies (19 and 20) on the compressor discharge air tubes (18). On the small end of air tubes (18), position the ring gaps 180 degrees apart with the gap of the seal rings to the outboard side of tubes (18). On the large end of air tubes (18), position the ring gaps 180 degrees apart with the gap of the seal rings to the inboard side of tubes (18).

e. Insert the left-hand compressor discharge air tube (18) through the firewall. Compress the seal ring with the compressor discharge air tube-to-compressor scroll installation clamp, tool No. 6799953. (See figure 2-3.) Mate the air tube (18) with the compressor scroll; then, remove the installation clamp.

f. Install the right-hand compressor discharge air tube (18) in the same manner used for installing the left-hand tube.

g. Compress the seal rings at the large end of air tubes (18) with the compressor discharge air tube-to-outer combustion case installation clamps, tool No. 6799952. (See figure 2-3.) Then, place the outer combustion case (6) over combustion liner (3) while mating case (6) to compressor discharge air tubes (18). Case (6) is properly indexed when the drain port is at the bottom of the engine. Also, check to ensure that the igniter plug hole in outer combustion case (6) aligns with the igniter plug hole in combustion liner (3) before inserting attaching bolts.

h. Coat the threads of the 24 outer combustion case attaching bolts (1, 2) lightly with antiseize compound (item 15, table 2-2). Secure the outer combustion case (6) to the gas producer turbine support with the 24 bolts (1, 2) and nuts (5). The half-inch length bolt is used to secure the thermocouple harness clamp (4) on the rear side of the splitline flange at bolt position 6 (viewed from the rear of the engine with 1 at top center). Tighten nuts (5) to 20-30 in. lb. Remove the installation clamps. Secure compressor discharge air tubes (18) to outer combustion case (6) with retaining rings (17).

i. If removed, install the following in outer combustion case (6):

(1) Apply antiseize compound (item 15, table 2-2) to the threads; then install burner drain valve (14) and plug (12) with new preformed packing (11 and 13). Tighten the drain valve and the plug to 120-140 in. lb.

(2) Install the fuel nozzle (7). *Do not* apply antiseize compound to the fuel nozzle threads. Tighten the fuel nozzle to 200-300 in. lb.

(3) Install the spark igniter (10). *Do not* apply antiseize compound to the spark igniter threads. Tighten the spark igniter (10) to 150-200 in. lb. and secure to the fuel nozzle (7) with lockwire (item 10, table 2-2).

j. Install the fireshield-to-fuel nozzle hose (8). Tighten the coupling nuts to 80-120 in. lb.

k. Attach the spark igniter lead (9) to the spark igniter (10). Tighten coupling nut to 70-90 in. lb. Apply antiseize compound (item 15, table 2-2) lightly to the threads of the drain valve (14). Clamp the igniter lead (9) to the drain valve using clamp and bracket assembly (15). Secure the clamp and bracket using a jam nut (16). Tighten jam nut (16) to 55-80 in. lb.

l. Attach the drain hose to the burner drain valve of the airframe installed engine.

m. Make appropriate entry relative to combustion section replacement in the Engine Log.

9-3. Test Run.

Test run the engine after combustion section replacement. (Refer to Chapter 10.)

CHAPTER 10

FINAL ENGINE TEST

10-1. Scope.

This chapter provides instructions for conducting functional tests following repair or replacement of parts.

10-2. Preparation for Test.

Engine testing may be accomplished with the engine installed in the airframe or on a mobile engine test stand.

a. Engine Installation in Airframe. Install the engine in the airframe as outlined in the applicable aircraft maintenance manual TM 55-1520-228-23.

b. Engine Installation on Test Stand. Install the engine on the mobile engine test stand, part No. LTCT10465-02 (NSN 4920-00-167-9178), as outlined in TM 55-4920-328-13.

10-3. Instrumentation Requirements.

Engine testing may be accomplished using no more than standard aircraft instrumentation to monitor the following parameters.

a. Turbine Outlet Temperature (0-1000°C)

b. Output Shaft Torque (0-110 psi)

c. Oil Pressure (0-150 psi)

d. Gas Producer (N1) Speed (0-110%)

e. Power Turbine (N2) Speed (0-120%)

10-4. Engine Motoring Procedure.

a. Engine Installed in Airframe.

(1) Disconnect the power input lead from the ignition exciter or pull IGN ENG circuit breaker.

(2) Ensure that the throttle (twist grip) is in the FUEL CUTOFF position.

(3) Ensure that the collective pitch control is at the minimum position.

(4) Press and hold the starter-ignition button to motor the engine. Release the button to stop motoring.

b. Engine Installed on Test Stand.

(1) Prepare the test stand for operation as outlined in TM 55-4920-328-13.

(2) Place the N1 throttle lever to the zero degree position as indicated on the throttle position indicator.

(3) Place the governor lever to the minimum lever.

NOTE

Do not press the ignition switch.

CAUTION

Ensure that lubricating oil is available at the engine oil inlet port. Damage to the engine could result if lubricating oil was not available at the oil inlet port at the start of the motoring procedure.

(4) Press the start switch to motor the engine. Press the start switch a second time to stop motoring.

10-5. Engine Operating Procedures.

NOTE

Refer the the applicable TM 55-1520-235-10 for starting, operating, and shutdown procedures when the engine is to be tested in the airframe.

The following operating procedures apply when the engine is installed on the test stand.

a. Starting.

(1) Prepare the test stand for operation as outlined in TM 55-4920-328-13.

CAUTION

To prevent fuel starvation at engine start and to prevent engine damage due to lack of lubricating oil at engine start, ensure that fuel and lubrication oil are available at the engine fuel and oil inlet ports.

(2) Place the N1 throttle lever to the zero degree position as indicated on the throttle position indicator.

(3) Place the governor lever to the minimum position.

CAUTION

Abort the start if any of the following conditions occur:

1. Time from starter ON to idle speed exceeds one minute. Investigate and correct cause before attempting another start.

2. Engine oil pressure does not start to increase by the time gas producer rotor speed (N1) reaches 20% speed. Investigate and correct cause before attempting another start.

3. No indication of power turbine rotor speed (N2) by the time gas producer rotor speed (N1) reaches 30% speed. Investigate and correct cause if malfunction was of test stand origin. Reject engine if malfunction was of engine origine.

4. Indicated TOT exceeds 1490°F (810°C) for more than 10 seconds with a momentary peak of one second at 1700°F (927°C). Refer to Table 12-1.

5. Indicated TOT exceeds 1700°F (927°C) or remains at 1700°F (927°C) for more than one second. Refer to Table 12-1.

(4) Simultaneously press the start switch ignition switch, and timer start switch.

CAUTION

Do not advance the N1 throttle lever above the 0° position (fuel cutoff) until the proper cranking speed is attained. An overtemperature start or an explosive lightoff may occur.

(5) When N1 speed reaches the value listed below, advance the N1 throttle lever to 30 degree position (idle). If there is no immediate TOT indication, retard the throttle lever to the 0 degree position (fuel cutoff). Investigate to determine the cause for no lightoff.

Ambient temperature	N1 speed
7 to 54°C (45 to 130°F)	15%
−18 to 7°C (0 to 44°F)	13%
−54 to −18°C (−65 to −1°F)	12%

(6) At 58% N1 speed, press the start switch, and ignition switch to cut off starter and ignition.

(7) The engine should continue to accelerate and stabilize at 62-63% N1 speed (idle).

(8) Oil pressure should be at least 50 psi.

NOTE

During cold weather, oil pressure up to 150 psi is permissible. Operate at idle until normal pressure limits can be maintained.

b. *Operating.*

(1) *Idle.* Idle is the same setting as for starting and is established with the governor lever at the minimum position and the N1 throttle lever at the idle (30°) opposition. Other determining factors are:

N1 speed = 62 to 63%
N2 speed = 75 to 105%
GPTOT = Determine from figure 10-1.
Torque pressure = 0 to 11 psi

(2) *Flight autorotation.* Flight autorotation is established with governor lever in the minimum position and the N1 throttle lever at any position between idle (30°) and maximum (90°). Other determining factors are:

N1 speed — 63% (estimated)
N2 speed — 98 to 108% normal (See table 10-1 for exception)
GPTOT — Determine from figure 10-1.
Torque pressure — 0 to 5 psi

(3) *Takeoff.* Takeoff is established with the N1 throttle lever at maximum (90°), the governor lever positioned to produce 100% N2 and the engine loaded to produce 1490°F GPTOT. Other determining factors are:

N1 speed — 104% max
Torque pressure — 100 psi max

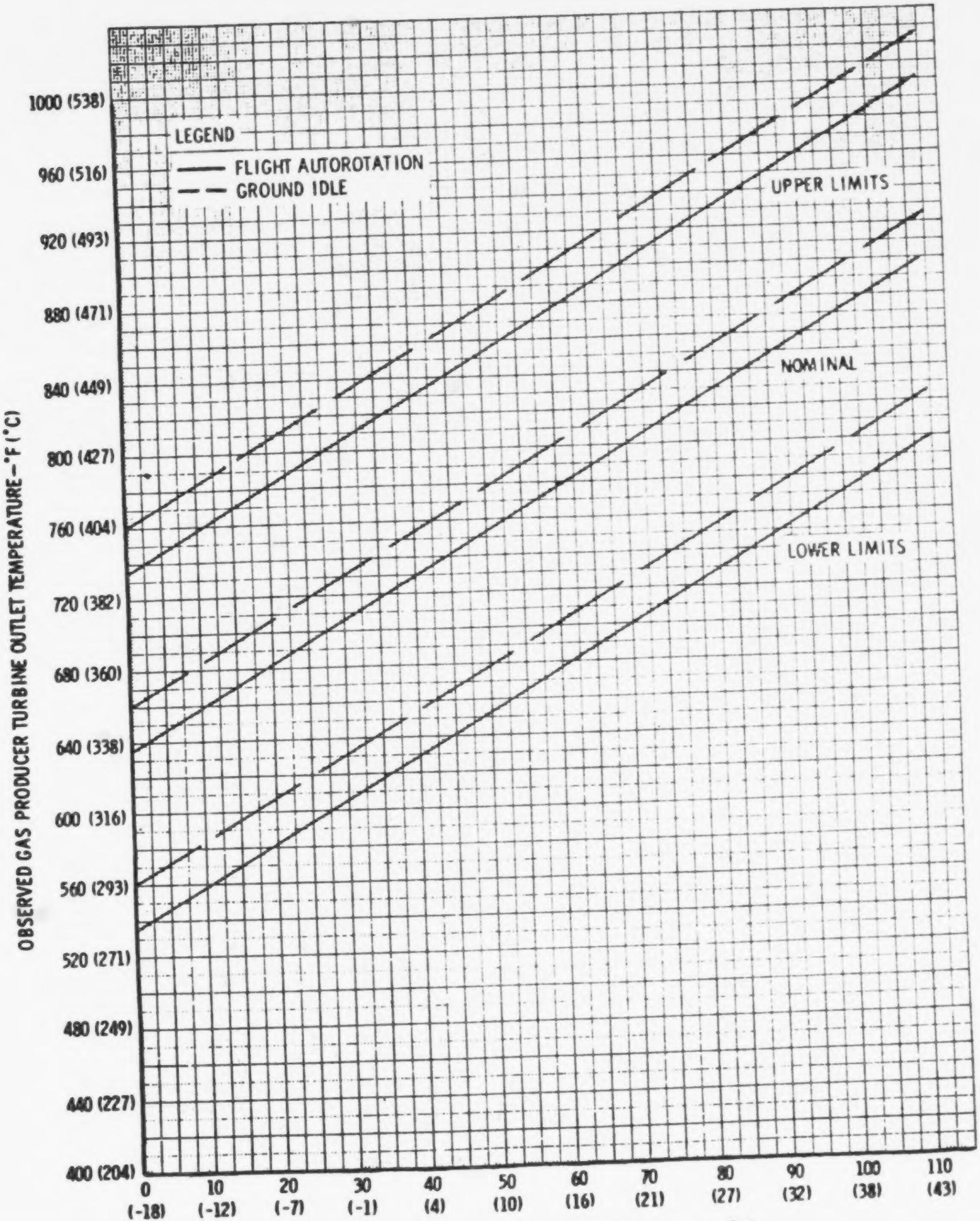


Figure 10-1. Idle and Flight Autorotation GPTOT Limits

c. Normal Shutdown.

(1) Place the N1 throttle lever to the ground idle (30°) position and the governor lever to the minimum position.

(2) Stabilize at idle for two minutes.

(3) Move the N1 throttle lever to the fuel cutoff (0°) position.

(4) Shut down the test stand as outlined in TM 55-4920-328-13.

d. Emergency Shutdown.

(1) Press the instrument power off switch and move the N1 throttle lever to the fuel cutoff (0°) position.

(2) If time permits, position the test set switches and controls as outlined in TM 55-4920-328-13.

10-6. Operating Parameters.

Observe the engine operating parameters (limits) in table 10-1 during all phases of engine testing.

Table 10-1. Operating Limits

Item	Limit	Remarks
N1 speed		
Rated	100%	
Maximum continuous	*105%	
Maximum transient	*106%	Permitted for 15 seconds maximum.
N2 speed		
Rated	100%	
Maximum continuous		See note.
Takeoff	*103%	
Flight autorotation	*108%	
Maximum transient		See note.
Takeoff	*105%	Permitted for 15 seconds maximum.
Flight autorotation	*113%	Permitted for 15 seconds maximum.

NOTE

Maximum continues and maximum transient speeds vary linearly from flight autorotation to takeoff. (Refer to TM 55-1520-235-10.) Send the engine to repair/overhaul if limit is exceeded.

*Send the engine to repair/overhaul if limit is exceeded.

Output Shaft Torque Limit

Torque lb ft	Pressure PSI	Percent OH-58C	Time Limit
393	109	146*	10 sec
384	104	144*	30 min
323	88	120	continuous

*Not readable on OH-58C Torquemeter instrument.

GPTOT		
Maximum takeoff	1490° F (810° C)	Permitted for 30 minutes maximum.
Maximum continuous	1360° F (738° C)	Permitted for continuous operation.
Maximum transient	1490-1550° F (810-843° C)	Permitted for 6 seconds maximum.
Maximum starting	1490-1700° F (810-927° C)	Permitted for 10 seconds maximum.

NOTE

If temperature limits are exceeded, inspect the turbine as outlined in Chapter 12.

Table 10-1. Operating Limits (Continued)

Item	Limit		Remarks
	Test Stand	*Airframe*	
Maximum vibration (200 cps filter)			
Transient			
Compressor	1.2 inch/second	2.0 inch/second	If limits are exceeded shut down immediately. Investigate to determine cause.
Turbine	1.8 inch/second	3.0 inch/second	
Gearbox	1.0 inch/second		
Steady state			
Compressor	0.6 inch/second	0.9 inch/second	
Turbine	0.9 inch/second	1.5 inch/second	
Gearbox	0.5 inch/second		

NOTE

Vibration test required after initial installation of engine in aircraft or when excessive vibration is suspected (refer to paragraph 12-8).

Item	Limit	Remarks
Oil pressure		
During start	Increasing pressure by the time 20% N1 is reached	Abort start if pressure does not start increasing.
Idle to 78% N1	50 psig minimum	
78-89% N1	90-130 psig	
90% N1 and above	115-130 psig	

NOTE

Oil pressure limits are based on an oil inlet temperature of 180-225°F (82-107°C).

Item	Limit	Remarks
Oil temperature		
For starting	-65°F minimum (-54°C)	
For operation above idle*	35°F miminum (2°C)	Operate at idle until within limit.
Normal range	180-200°F (82-93°C)	
Maximum	225°F maximum (107°C)	Reduce power to maintain limit.

NOTE

During cold weather operations, 150 psig engine oil pressure is permitted following engine start. When the 130 psig limit is exceeded, operate engine at idle RPM until normal engine oil pressure is obtained. When engine oil pressure is within normal limits, engine may be operated within full range of temperature limits (-54 to 107°C) without regard to engine oil temperature markings.

* For test cell only.

10-7. Test Requirements.

a. Table 10-2 lists the test requirements following repair or replacement of an engine component or accessory. Parts removed to gain access to other parts or areas shall invoke the same test requirements, in accordance with the table of test requirements, as parts repaired or replaced to correct deficiencies or malfunctions. In the event that more than one test requirement is invoked, the most severe shall apply.

b. Setting numbers listed in the functional test column of table 10-2 refer to the setting numbers in the functional test schedule (table 10-3).

Table 10-2. Test Requirements

Item	Parts replaced or repaired	Functional test	Remarks
1	Gearbox seals	Settings 3 thru 6	Check for leaks.
2	Oil pressure reducer	Settings 1 thru 6	Ensure oil pressure is within limits of table 10-1.
3	Lube oil check valve	Settings 1 thru 6	Ensure oil pressure is within limits of table 10-1.
4	Oil filter housing and associated valves	Settings 3 thru 6	Adjust oil pressure regulating valve. (Refer to paragraph 5-26.) Ensure oil pressure within limits of table 10-1.
5	Spark igniter	Settings 1 and 2	Ensure satisfactory start.
6	Ignition exciter	Settings 1 and 2	Ensure satisfactory start.
7	Compressor bleed valve	Settings 3 thru 6	Ensure valve operates within limits of figure 1-9.
8	Fuel control	Settings 1 thru 6	Make fuel control adjustments as required. (Refer to paragraph 5-12.) Ensure engine operates within limits of table 10-1.
9	Governor	Settings 1 thru 6	Ensure engine operates within limits of table 10-1.
10	Fuel pump	Settings 1 thru 6	Ensure engine operates within limits of table 10-1.
11	Compressor rotor	Settings 1 thru 6	Ensure engine operates within limits of table 10-1.
12	Compressor case	Settings 1 thru 6	Ensure engine operates within limits of table 10-1.
13	Combustion liner	Settings 3 thru 6	Ensure engine operates within limits of table 10-1.
14	Combustion outer case	Settings 3 thru 6	Ensure engine operates within limits of table 10-1.
15	Compressor discharge air tube(s)	Settings 3 thru 6	Ensure engine operates within limits of table 10-1.
16	Double check valve	Settings 3 thru 6	Check for leaks.
17	Fuel filter element	Settings 1 and 2	Check for leaks.
18	Oil filter element	Settings 1 and 2	Check for leaks.
19	Fuel, oil, and air piping	Settings 1 and 2	Check for leaks.
20	Pc air filter	Settings 1 and 2	Check for leaks.

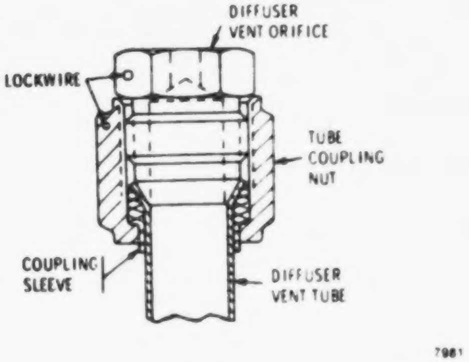


Figure 10-2. Diffuser Vent Orifice Installation

10-8. Functional Test Schedule.

Table 10-3 lists the power settings and sequence of events for performing an engine functional test run. Perform the applicable portions of the test as outlined in table 10-2. The engine must operate within the limits specified in table 10-1.

10-9. Diffuser Vent Orifice Selection.

If the compressor shows evidence of oil leakage or smoking at the diffuser vent tube, select a new orifice as follows:

a. Clean the area around the orifice.

b. Perform settings 7 through 10 of the test run schedule in table 10-3.

c. After the test run, inspect the area around the orifice. If there is any evidence of smoking or spewing from the vent, reduce the orifice size by installing the next lower dash number orifice. (See figure 10-2.) Secure the orifice with lockwire (item 32, table 2-2).

d. Repeat the run, inspection, and orifice replacement until no evidence of spewing or smoking is present.

10-10. Fuel Requirements.

The fuel used for testing shall conform to item 33, table 2-2. The fuel supply system shall be capable of supplying 350 pounds per hour flow over the range of 5 to 45 psig inlet pressure. A sufficient number of 5 micron (#200 mesh screen) filter elements shall be provided to adequately filter the fuel and allow the required flow rate.

10-11. Lubricating Oil Requirements.

The engine lubricating oil used for testing shall conform to item 7, table 2-2. The oil supply system shall be capable of maintaining oil inlet pressure within 0 to 1.8 psig and oil inlet temperature within the range of 180 to 225°F. A sufficient number of 25 micron filters shall be provided to adequately filter the scavenge oil.

10-12. Electrical Supply Requirements.

a. The ignition exciter requires a d-c power supply of 28 volts (4 amps minimum).

b. The starter requires a source of external power capable of 350 to 400 amperes, and 28 volts is recommended for starting the engine; however, limits of 300 to 750 amperes and 28 volts are allowable for starting the engine.

10-13. Drainage Requirements.

When the engine is to be tested on the test stand, drain bottles shall be provided to collect drainage from the burner drain valve, fuel pump seal drain, firewall shield drain and exhaust collector drain. Combine drainage shall not exceed 2 cc/minute, except fuel pump seal drainage shall not exceed 0.5 cc/minute, of this total.

10-14. Preservation Requirements.

Engines which are not scheduled for immediate installation into the airframe shall be preserved as outlined in Chapter 3.

Table 10-3. Functional Test Schedule

Setting No.	Condition	Time (minutes)	N1 speed (%)	N2 speed (%)	GPTOT °F(°C)	Torque Press (psi)	Note ref
1	Start engine (accelerate to idle)	5 max	62 to 63		See fig. 10-1	0-11	A
2	Shut down						
3	Start engine (accelerate to idle)		62 to 63		See fig. 10-1	0-11	B
4	Takeoff	2		100	1490 (810)	100	C
5	Idle	2	62 to 63		See fig. 10-1	0-11	D
6	Shut down						E,F
7	Start engine (accelerate to idle)		62 to 63		See fig. 10-1	0-11	
8	Takeoff	5		100	1490 (810)	100	G
9	Idle	2	62 to 63		See fig. 10-1	0-11	
10	Shut down						H

NOTES

A	Observe engine for abnormal conditions such as vibration, noise, or leakage.
B	Make idle speed and start derichment adjustments if required. (Refer to paragraph 5-12.) Adjust oil pressure regulator if required. (Refer to paragraph 5-26.)
C	If the engine is being tested in the airframe, limit collective to just short of lift-off.
D	Check operation of the anti-icing valve.
E	Give the engine a thorough visual inspection after shutdown. Repeat the check run if any repairs are necessary as a result of the run or the inspection.
F	The check run is complete after setting No. 6 unless blend repair has been performed on the compressor rotor or case. To check engine performance, continue to the completion of the listed check run settings.
G	If the engine is being tested in the airframe, make a test flight I/A/W TM 55-1520-228-MTF and TM 55-1500-328-25 and observe published operating limits.
H	Check the diffuser vent orifice. Repeat settings 7 through 10 until the proper orifice size is determined. (Refer to paragraph 10-9).

CHAPTER 11

TORQUES AND DIMENSIONAL LIMITS

Section I. TORQUE VALUES

11-1. General.

Table 11-1 lists torque values for bolts, screws, studs, flared tubing, tube fittings, flexible hose connectors, etc. and are presented as a specific value for each individual application. The torque values are listed in numerical order by figure reference number.

Table 11-1. Torque Values

Ref. No.	Fig. No.	Description	Minimum (in. lb)	Maximum (in. lb)
1	3-1	Shipping Container Closure Flange Nuts	150	165
7	3-1	Shipping Container Mounting Adapter Nut	40	50
10	3-1	Shipping Container Mounting Bracket Bolts	85	110
17	3-1	Shipping Container Records Receptacle Nuts	30	45
26	3-1	Shipping Container Service Receptacle Nuts	15	25
7	3-4	Accessory Shipping Container Locking Ring Nut	65	75
5	3-8	Outer Combustion Case Splitline Nuts	20	30
12	3-8	Combustion Case Drain Plug	120	140
14	3-8	Burner Drain Valve	120	140
16	3-8	Igniter Lead-to-Combustion Case Bracket Nut	55	80
3	5-2	Control-to-Pump Fuel Tube		
		Fittings	75	110
		Coupling Nuts	150	200
4	5-2	Pump-to-Control Fuel Tube		
		Fittings	75	110
		Coupling Nuts	150	200
5	5-2	Governor-to-Control Air Tube		
		Fitting (in control)	75	110
		Coupling Nuts	80	120
6	5-2	Governor-to-Accumulator Air Hose		
		Fitting (in governor)	75	110
		Coupling Nuts	80	120
7	5-2	Control-to-Regulator Air Tube		
		Fitting Jam Nuts	55	80
		Coupling Nuts	80	120
9	5-2	Control-to-Governor Py Air Tube		
		Fitting (in control)	75	110
		Coupling Nuts	80	120
11	5-2	Pc Filter-to-Governor Air Tube		
		Fitting Jam Nuts	55	80
		Coupling Nuts	80	120

Table 11-1. Torque Values (Continued)

Ref. No.	Fig. No.	Description	Minimum (in. lb)	Maximum (in. lb)
13	5-2	Firewall Shield-to-Fuel Nozzle Hose Coupling Nuts	80	120
14	5-2	Gas Turbine Scavenge Oil Tube		
		Fitting Jam Nut	75	110
		Coupling Nuts	150	200
15	5-2	Accumulator-to-Control Air Tube		
		Fitting Jam Nuts	55	80
		Coupling Nuts	80	120
16	5-2	Control-to-Firewall Shield Fuel Tube		
		Fireshield Fitting Jam Nut	55	80
		Coupling Nuts	80	120
17	5-2	Check Valve-to-Turbine Pressure Oil Tube		
		Fitting Jam Nut	75	110
		Coupling Nuts	150	200
18	5-2	External Sump Scavenge Oil Tube		
		Fitting Jam Nut	75	110
		Coupling Nuts	150	200
22	5-2	Gearbox-to-Check Valve Pressure Oil Tube		
		Fitting Jam Nut	75	110
		Coupling Nuts	150	200
23	5-2	Fuel Supply Hose		
		Fitting	75	110
		Coupling Nut	150	200
25	5-2	After Filter Pressure Hose		
		Fitting	55	80
		Coupling Nut	80	120
26	5-2	Fuel Pump Seal Drain Hose		
		Fitting	55	80
		Coupling Nut	80	120
27	5-2	Before Filter Pressure Hose		
		Fitting	55	80
		Coupling Nut	80	120
6	5-3	Fuel Nozzle	200	300
19	5-3	Power Turbine Governor Mounting Flange Nuts	70	85
29	5-3	Fuel Pump Mounting Flange Nuts	70	85
42	5-3	Gas Producer Fuel Control Mounting Flange Nuts	70	85
53	5-3	Accumulator and Check Valve Clamp Attaching Nuts	35	40
58	5-3	Pg Accumulators-to-Check Valve	55	80
59	5-3	Check Valve-to-Accumulator Elbow	55	80
60	5-3	Accumulator-to-Air Tube Unions	55	80
60	5-3	Elbow-to-Check Valve Union	55	80
64	5-3	Pc Filter Clamp Attaching Nuts	35	40
72	5-3	Py Accumulator-to-Governor Union	55	80
73	5-3	Py Accumulator	55	80
8	5-4	Fuel Filter Cover Screws	95	105
1	5-8	Fuel Control Fuel Filter Plug	65	70
None	None	Fuel Control and Governor Lever Shaft Nuts	40	60
None	5-10	Magnetic Chip Detectors	60	80

Table 11-1. Torque Values (Continued)

Ref. No.	Fig. No.	Description	Minimum (in. lb)	Maximum (in. lb)
1	5-11	Oil Filter Cap Nuts	30	45
7	5-11	Oil Filter Housing Mounting Flange Nuts	35	40
5	5-12	External Oil Check Valve Clamp Nuts	35	40
7	5-12	Oil Pressure Reducer	50	75
8	5-12	Compressor Front Support Pressure Oil Tube		
		Fitting	50	75
		Coupling Nuts	65	100
1,3,31	5-13	Scroll-to-Bleed Valve Air Tube		
		Fitting Jam Nuts	55	80
		Coupling Nuts	80	120
9, 12	5-13	Bleed Valve Mounting Flange Nuts		
		1/4-28 Nut	70	85
		10-32 Nuts	35	40
15	5-13	Anti-Icing Valve Poppet Guide	65	75
23	5-13	Anti-Icing Air Tube (RH) Coupling Nuts	150	200
24	5-13	Anti-Icing Valve Jam Nut	100	150
26	5-13	Anti-Icing Air Tube (LH) Coupling Nuts	150	200
1	5-16	Ignition Exciter Input Lead Nut	8	12
4	5-16	Ignition Exciter Mounting Nuts	30	40
6, 16	5-16	Igniter Lead Clamp Nuts	35	40
12	5-16	Igniter Lead-to-Fireshield Attaching Nuts	35	40
13	5-16	Igniter Lead-to-Combustion Case Mounting Bracket Nut	55	80
18	5-16	Igniter Lead Coupling Nuts		
		Lead-to-Exciter	50	70
		Lead-to-Igniter	70	90
19	5-16	Spark Igniter	150	200
None	None	Thermocouple Terminal Assembly Mounting Nuts	35	40
None	None	Thermocouple Leads-to-Terminal Assembly Nuts		
		No. 8-32 Nut	17	25
		No. 10-32 Nut	17	25
3	6-1	Compressor Case-to-Front Support Nuts	10	15
6	6-1	Compressor Case-to-Front Diffuser Nuts	10	15
7	6-1	Compressor Case Horizontal Splitline Nuts	10	15
7	7-1	**Compressor Bleed Valve Jet**	8	12
8	7-1	**Compressor Bleed Valve Nozzle**	50	60
1	7-16	Turbine-to-Gearbox Mounting Stud (Upper)	105	210
2	7-16	Turbine-to-Gearbox Mounting Studs (Lower)	50	100
3	7-16	Rear Power Takeoff Pad Studs	50	100
4	7-16	Fuel Control and Governor Pad Studs	50	100
5	7-16	Starter-Generator Pad Studs	105	210
6	7-16	Fuel Pump and Spare Accessory Pad Studs	50	100
7	7-16	Oil Filter Housing Mounting Studs (Short Studs)	20	40
8	7-16	Oil Filter Housing Mounting Studs (Long Studs)	20	40
9	7-16	Oil Filter Housing Mounting Studs (Medium Length Stud)	20	40
10	7-16	Tachometer Pad Studs	50	100
11	7-16	Front Power Takeoff Pad Studs	50	100
12	7-16	Ignition Exciter Mounting Studs	20	40

Section II. DIMENSIONAL LIMITS

11-2. General.

This section provides limits for determining and maintaining proper relationship between mating parts within an assembly. Table 11-2 includes all clearances, backlashes, plays, runouts, etc., arranged in numerical order by figure reference number.

Table 11-2. Dimensional Limits

Ref. No.	Fig. No.	Description	Minimum (in.)	Maximum (in.)
3	7-16	Rear Power Takeoff Pad Studs Setting Height	0.91	0.95
4	7-16	Fuel Control and Governor Pad Studs Setting Height	0.60	0.64
5	7-16	Starter-Generator Pad Studs Setting Height	0.89	0.93
6	7-16	Fuel Pump and Spare Accessory Pad Studs Setting Height	0.85	0.89
7, 8, 9	7-16	Oil Filter Housing Mounting Studs Setting Height		
		Short Studs	0.54	0.58
		Medium Length Studs	0.79	0.83
		Long Studs	1.17	1.21
10	7-16	Tachometer Pad Studs Setting Height	0.62	0.66
11	7-16	Front Power Takeoff Pad Studs Setting Height	0.62	0.66
12	7-16	Ignition Exciter Mounting Studs Setting Height	0.42	0.46

CHAPTER 12

SPECIAL INSPECTIONS

Section I. ENGINE HOT END

12-1. Scope.

This section presents special instructions to be performed on the turbine when the engine has experienced operation beyond allowable temperature limits. Tables 12-1 and 12-2 list the various overtemperature conditions for starting and power transients and the maintenance action required for each.

Table 12-1. Overtemperature During Start

Temperature range	Time	Maintenance action
810-927°C (1490-1700°F)	Over 10 seconds	Inspect turbine.*
Over 927-999°C (1700-1830°F)	Anytime	Inspect Turbine.*
Over 999°C (1830°F)	Anytime	Remove engine for depot maintenance or overhaul.

NOTE

1. Refer to item 6, table 4-1 when start temperature consistently exceeds 843° C (1550° F).
2. The time-at-temperature limits are not additive and may be repeated without restrictions.

*Refer to Turbine Overtemperature Inspection paragraph 12-2.

Table 12-2. Overtemperature During Power Transients

Temperature range	Time	Maintenance action
810-843° C (1490-1550° F)	Over 6 seconds	Inspect turbine*
843-927° C (1550-1700° F)	Anytime	Inspect turbine*
Over 927° C (1700° F)	Anytime	Remove engine for depot maintenance or overhaul.

NOTE

The time-at-temperature limits are not additive and may be repeated without restrictions.

*Refer to Turbine Overtemperatures Inspection paragraph 12-2.

12-2. Turbine Overtemperature Inspection.

NOTE

This inspection may be performed with the engine installed in the airframe.

a. Remove the combustion section. (Refer to paragraph 3-21.)

NOTE

Removal of the first-stage turbine nozzle from the turbine is not authorized.

b. Inspect the first-stage turbine nozzle and shield as outlined in table 12-3. (See figure 12-1.)

c. Visually inspect the N1 turbine first-stage blades. Replace the engine if any of the following conditions exist:

(1) Damaged inner ⅓ of blade.
(2) Blade broken off.
(3) Cracked blade.
(4) Melted blade.

d. Inspect the combustion liner. (Refer to table 7-1.)

Table 12-3. First-Stage Turbine Nozzle and Shield Inspection

Item	Condition	Serviceable limits
First-Stage Nozzle		
1	Axial cracks in vane airfoil.	Leading edge ¼ in. maximum; trailing edge 5/16 in maximum. a. No two cracks in same plane. b. Adjacent cracks ¼ in. apart. c. Adjacent cracks not progressing toward each other.
2	Nicked or dented leading and trailing edge. Warped or burned trailing edge only.	Leading edge 1/16 in. maximum; trailing edge 1/8 in. maximum.
3	Fillet cracks—inner and outer band.	Leading edge ¼ in. maximum; trailing edge 1/8 in. maximum.
4	Outer band cracks—leading and trailing edges.	Visible portion of crack extends 3/16 in. maximum axially into the band and not in line with crack on opposite edge.
5	Inner band cracks—leading and trailing edges.	Leading edge—visible portion of crack extends 3/16 in. maximum axially into the band and not in line with trailing edge cracks. Trailing edge—extending through inner band to sheet metal detail.
First-Stage Nozzle Shield		
6	Cracks around spotwelds on heat shield.	Cracks are acceptable provided the length of the crack is not greater than 50 percent of the distance around the weld.

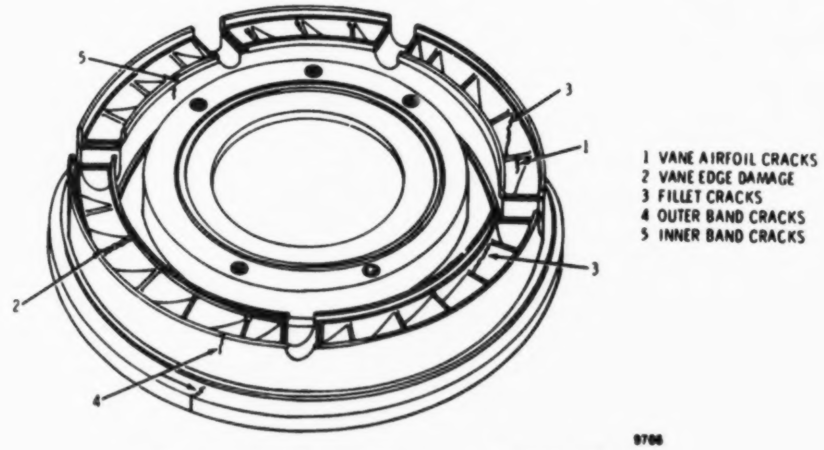


Figure 12-1. Typical First-stage Turbine Nozzle

Section II. COMPRESSOR

12-3. Scope.

This section presents special inspections to be performed on the engine when damage has been sustained due to operation under abnormal conditions or operation in severe climatic conditions.

12-4. Snow and Ice Ingestion Inspection.

This inspection must be performed following an inflight flameout in ice producing weather or anytime snow and ice ingestion is suspected. Inspect the compressor for snow, ice, or water damage as follows:

a. Obtain access to the compressor inlet but do not disassemble any engine parts.

b. Inspect the compressor front support vanes and first-stage rotor blades. Replace the engine if any mechanical damage, bending, or distortion is detected.

12-5. Compressor Inlet Blockage Inspection.

Replace the engine if it has been operated with inlet air restricted due to foreign objects or materials which have become lodged in the compressor inlet. Tag the replaced engine to show that the cause of removal was inlet air blockage. Conditions which constitute blockage are as follows:

a. Foreign objects or materials found in the inlet during inspection of the aircraft when not in operation. If it can be determined that the blockage was not there during the last operation of the engine, remove the foreign object or material and leave the engine in service.

b. Power loss encountered following a restriction at the compressor inlet area while the engine is in operation. Blockage in flight can usually be verified by inspection after landing (blockage still exists). However, some blockage may be followed by ingestion before inspection can take place. Objects or materials which were large enough to have stopped at the inlet guide vanes before ingestion should be considered to have caused compressor inlet blockage.

12-6. Foreign Object Damage (FOD) Inspection.

Power loss associated with an increase in engine vibration can often be attributed to foreign object damage. Inspect for foreign object damage as follows:

a. Obtain access to the compressor inlet but do not disassemble any engine parts.

b. Inspect the compressor front support vanes and first-stage rotor blades and vanes for FOD.

c. If the inspection in step *b* is inconclusive, remove one compressor case half and check for FOD. (Refer to paragraph 6-2.)

d. If the compressor FOD is detected, remove the combustion section (paragraph 3-21) and check the turbine first-stage vanes and blades for FOD.

e. If compressor or turbine FOD is detected, replace the engine.

12-7. Erosion Inspection.

If the engine is frequently subject to sand and dust ingestion causing reduced engine performance (evidenced by high TOT and low torque), compressor erosion inspection is recommended. (Refer to paragraphs 7-10 and 7-11.)

12-8. Vibration Inspection.

NOTE

> Perform engine vibration test after initial installation of engine in aircraft, after removal of combustion case, when excessive engine vibration is suspected; or when any maintenance has been performed that may effect engine to transmission alignment. The engine vibration test requirement shall apply to all engines installed, reinstalled, new, overhauled, same or different.

If engine vibration is encountered, determine the origin of the vibration as follows and repair or replace the engine as applicable.

a. Install vibration monitoring kit, tool No. 171170-0104, in accordance with TM 55-4920-243-15.

b. Run the engine and check for vibration in excess of the limits specified in table 10-1. Note the origin of the vibration.

c. If the compressor, turbine, or gearbox vibration limits are exceeded, replace the engine.

Section III. ABNORMAL FLIGHT MANEUVER INSPECTION

12-9. Hard Landing Inspection.

a. Replace the engine if landing forces exceed 10g. Use the airframe condition to determine if the 10g force limit has been exceeded. If the airframe landing skids and cross tubes are deformed to a degree that the fuselage touches (or shows evidence of having touched) the ground, the 10g limit has been exceeded.

b. If the conditions of step *a* do not apply, make an inspection of the engine for damage as follows:

(1) Check gearbox housing and flanges for cracks.

(2) Inspect magnetic chip detectors for metal particle accumulation.

(3) Check engine mounting pads for cracks.

(4) Check air, oil, and fuel tube connections for tightness and leaks.

(5) Check all engine accessories for cracked flanges, loose bolts and nuts, connections, and general condition.

(6) Install vibration monitoring kit, tool No. 171170-0104, in accordance with TM 55-4920-243-15. and operate the engine on the ground for 30 minutes. Check for vibration in excess of the limits specified in table 10-1.

(7) Shut down and check the magnetic chip detectors for metal particles.

12-10. Sudden Stoppage Inspection.

The following inspections must be accomplished whenever the main rotor or tail rotor strikes a stationary object.

a. Inspect the engine mounts for cracks and security. If stoppage was severe enough to fracture an engine mount, send the engine to overhaul.

b. Check the magnetic chip detectors for metal particles.

c. Inspect the compressor blades and vanes for foreign object damage.

d. Inspect the engine inlet for foreign objects.

e. Motor the engine and check for unusual noise.

f. Install vibration monitoring kit, tool No. 171170-0104, in accordance with TM 55-4920-243-15 and operate the engine on the ground for 30 minutes. Check that vibration is within limits specified in table 10-1.

g. Shut down and check the magnetic chip detectors for metal particles.

h. Reinspect the magnetic chip detectors after eight hours of engine operation.

CHAPTER 13

OVERHAUL INTERVAL AND RETIREMENT SCHEDULE

13.1 General.

Table 13-1 lists those items which have an established operating interval before they are overhauled or retired from service.

NOTE

TM 55-1500-328-25 should be referred to concerning mutilation/destruction of items, when they have reached the established life expectancy (finite life), before the items are forwarded for property disposal.

Table 13-1. Overhaul and Retirement Interval

Overhaul interval (hr)	Retirement interval (hr)	Item	Part number
1800		Engine	6887191
1800		Fuel Pump	6876721 (024918-104)
1800		Fuel Pump	6895172 (024918-106)
1800		Fuel Pump	6895653 (024918-107)
1800		Fuel Pump	23003114 (5002395)
1800		Fuel Pump	6896844 (386500-4)
1800		Fuel Pump	6899253 (386500-5)
1800		Bleed Valve	6889815
1800		Bleed Valve	6896348
1800		Bleed Valve	6899115
1800		Fuel Control	6895672 (2524632-3)
1800		Fuel Control	6898894 (2524632-6)
2000		Fuel Control	23007860 (2524911-2)
2000		Fuel Control	23007857 (2524644-21)
2000		Fuel Control	23007869 (2524644-24)
1800		Governor	6895673 (2524589-2)
1800		Governor	6898888 (2524589-5)
1800		Governor	23005489 (2524589-3)

Table 13-1. Overhaul and Retirement Interval – (Cont.)

Overhaul interval (hr)	Retirement interval (hr)	Item	Part number
1800		Governor	23006274 (2524912-1)
2000		Governor	23007877 (2524912-2)
2000		Governor	23007865 (2524769-10)
2000		Governor	23007506 (2524769-11)

APPENDIX A

REFERENCES

AR 750-22	Maintenance of Supplies and Equipment, Army Oil Analysis Program
MIL-M-3171	Magnesium Alloy, Processes for Pretreatment and Prevention of Corrosion on
MIL-STD-129	Marking for Shipment and Storage
TB 55-1500-314-25	Handling, Storage and Disposal of Army Aircraft Components Containing Radioactive Materials
TB 55-8100-200-24	Maintenance of Specialized Reusable Containers for Aircraft Equipment
TB 55-9150-200-24	Engine and Transmission Oils, Fuels, and Additives for Army Aircraft
TB 43-0106	Spectrometric Oil Analysis
TB 750-126	Use of Material Condition Tags and Labels on Army Aeronautical and Air Delivery Equipment
TM 38-750	The Army Maintenance Management Systems (TAMMS)
TM 55-406	Fundamentals of Aircraft Powerplant Maintenance
TM 55-1500-204-25/1	General Aircraft Maintenance Manual
TM 55-1500-328-25	Aeronautical Equipment, Maintenance Management Policies and Procedures
TM 55-1520-228-MTF	OH-58A Maintenance Test Flight
TM 55-1520-235-10	Operator's Manual: Army Model OH-58C Helicopter
TM 55-1520-228-23	AVUM and AVIM Maintenance Manual, Army Model OH-58A Helicopter and OH-58C Helicopters
TM 55-4920-243-15	Operator, Organizational, DS, GS, and Depot Maintenance Manual: Vibration Monitoring Kit
TM 55-4920-244-14	Tester, Exhaust Gas Temperature, Model BH 112JA36
TM 55-4920-328-14	Operator's Organizational, DS, and GS Maintenance Manual for Engine Test System (LTCT 10465-02, NSN 4920-00-167-9178)
TM 750-244-1-5	Procedures for the Destruction of Aircraft and Associated Equipment to Prevent Enemy Use

APPENDIX B
MAINTENANCE ALLOCATION CHART
Section I. INTRODUCTION

B-1. Maintenance Allocation Chart

a. This Maintenance Allocation Chart (MAC) assigns maintenance functions in accordance with the Three Levels of Maintenance concept for army aircraft. These maintenance levels, Aviation Unit Maintenance (AVUM); Aviation Intermediate Maintenance (AVIM) and Depot Maintenance are depicted on the MAC as:

AVUM which corresponds to the O Code in the RPSTL
AVIM which corresponds to an F Code in the RPSTL
DEPOT which corresponds to a D Code in the RPSTL

b. The maintenance to be performed below depot and in the field is described as follows:

(1) Aviation Unit Maintenance (AVUM) activities will be staffed and equipped to perform high frequency "On-Aircraft" maintenance tasks required to retain or return aircraft to a serviceable condition. The maintenance capability of the AVUM will be governed by the Maintenance Allocation Chart (MAC) and limited by the amount and complexity of ground support equipment (GSE), facilities required, and number of spaces and critical skills available. The range and quantity of authorized spare modules/components will be consistent with the mobility requirements dictated by the air mobility concept. (Assignments of maintenance tasks to divisional company size aviation units will consider the overall maintenance capability of the division, the requirement to conserve personnel and equipment resources and air mobility requirements.)

(a) Company size Aviation Units perform those tasks which consist primarily of preventive maintenance and maintenance repair and replacement functions associated with sustaining a high level of aircraft operational readiness. Perform maintenance inspections and servicing to include preflight, daily, intermediate, periodic and special inspections as authorized by the MAC or higher headquarters. Identify the cause of equipment/system malfunctions using applicable technical manual troubleshooting instructions, built-in-test equipment (BITE), installed aircraft instruments, or easy to use/interpret diagnostic/fault isolation devices (TMDE). Replace worn or damaged modules/components which do not require complex adjustments or system alignment and which can be removed/installed with available skills, tools and equipment. Perform operational and continuity checks and make minor repairs to the electrical system. Inspect, service and make operational capacity and pressure checks to hydraulic systems. Perform servicing, functional adjustments, and minor repair/replacement to the flight control, propulsion, power train and fuel systems. Accomplish airframe repair which does not require extensive disassembly, jigging, or alignment. The manufacture of airframe parts will be limited to those items which can be fabricated with tools and equipment found in current air mobile tools and shop sets. Evacuate unserviceable modules/components and end items beyond the repair capability of AVUM to the supporting AVIM.

(b) Less than Company Size Aviation Units: Aviation elements organic to brigade, group, battalion, headquarters and detachment size units are normally small and have less than ten aircraft assigned. Maintenance tasks performed by these units will be those which can be accomplished by the aircraft crew chief or assigned aircraft repairman and will normally be limited to preventive maintenance, inspections, servicing, spot painting, stop drilling, application of nonstress patches, minor adjustments, module/component fault diagnosis and replacement of selected modules/components. Repair functions will normally be accomplished by the supporting AVIM unit.

(2) Aviation Intermediate Maintenance (AVIM) provides mobile, responsible "One Stop" maintenance support. (Maintenance functions which are not conducive to sustaining air mobility will be assigned to depot maintenance). Performs all maintenance functions authorized to be done at AVUM. Repair of equipment for return to user will emphasize support or operational readiness requirements. Authorized maintenance includes replacement and repair of modules/components and items which can be accomplished efficiently with avail-

able skills, tools, and equipment. Established the Direct Exchange (DX) program for AVUM units by repairing selected items for return to stock when such repairs cannot be accomplished at the AVUM level. Inspects, troubleshoots, tests, diagnoses, repairs, adjusts, calibrates, and aligns aircraft system modules/components. AVIM units will have capability to determine the serviceability of specified modules/components removed prior to the expiration of the Time Between Overhaul (TBO) or finite life. Module/component disassembly and repair will support the DX program and will normally be limited to task requiring cleaning and the replacement of seals, fittings and items of common hardware, Airframe repair and fabrication of parts will be limited to those maintenance tasks which can be performed with available tools and test equipment. Unserviceable reparable modules/components and end items which are beyond the capability of AVIM to repair will be evacuated to Depot Maintenance. This level will perform aircraft weight and balance inspections and other special inspections which exceed AVUM capability. Provides quick response maintenance support, including aircraft recovery and air evacuation on-the-job training, and technical assistance through the use of mobile maintenance contact teams. Maintain authorized operational readiness float aircraft. Provides collection and classification services for serviceable/unserviceable material. Operates a cannibalization activity in accordance with AR 750-50. (The aircraft maintenance company within the maintenance battalion of a division will perform AVIM functions consistent with air mobility requirements and conservation of personnel and equipment resources. Additional intermediate maintenance support will be provided by the supporting nondivisional AVIM unit).

B-2. Use of the Maintenance Allocation Chart

a. The Maintenance Allocation Chart assigns maintenance functions based on past experience and the following consideration:

(1) Skills available.

(2) Time required.

(3) Tools and test equipment required and/or available.

b. The assigned levels of maintenance authorized to perform a maintenance functions is indicated.

c. A maintenance function assigned to a lower maintenance level to be performed at any higher maintenance level.

d. A maintenance function that cannot be performed at the assigned level of maintenance for any reason may be evacuated to the next higher maintenance organization. Higher maintenance levels will perform the maintenance functions of lower maintenance levels when required or directed by the appropriate commander.

e. The assignment of a maintenance function will not be construed as authorization to carry the associated repair parts in stock. Information to requisition or otherwise secure the necessary repair parts will be specified in the Repair Parts, and Special Tools List.

f. Normally there will be no deviation from the assigned level of maintenance. In cases of operational necessity, maintenance functions assigned to a higher maintenance level may, on a one-time basis and at the request of the lower maintenance level, be specifically authorized by the maintenance officer of the higher level of maintenance to which the functions is assigned. The special tools, equipment, etc. required by the lower level of maintenance to perform this function will be furnished by the maintenance level to which the function is assigned. This transfer of a maintenance function to a lower maintenance level does not relieve the higher maintenance level of the responsibility of the function. The higher level of maintenance will provide technical supervision and inspection of the function being performed at the lower level.

g. Maintenance of the US Army Communications and Electronics Material Readiness Command equipment will be performed by designated US Army CERCOM personnel.

h. Changes to the Maintenance Allocation Chart will be based on continuing evaluation and analysis by responsible technical personnel and on reports received from field activities.

B-3. Definitions.

Maintenance functions. Maintenance functions will be limited to and defined as follows:

a. ***Inspect.*** To determine the serviceability of an item by comparing its physical, mechnical and/or electrical characteristics with established standards through examination.

b. ***Test.*** To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with the prescribed standards.

c. ***Service.*** Operations required periodically to keep an item in proper operating condition, i.e. to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. ***Adjust.*** To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e. ***Align.*** To adjust specified variable elements of an item to bring about optimum or desired performance.

f. ***Calibrate.*** To determine and cause corrections to be made or to be adjusted on instruments or test, measuring and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. ***Install.*** The act of emplacing, seating or fixing into position an item, part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. ***Replace.*** The act of substituting a serviceable like type part, subassembly or module, (component or assembly) for an unserviceable counterpart.

i. ***Repair.*** The application of maintenance services or other maintenance actions to restore serviceability to an item by correcting specific damage, fault, malfunctions or failure in a part, subassembly, module (component or assembly), end item, or system.

j. ***Overhaul.*** That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by the maintenance standard (i.e. DMWR) in the appropriate technical publication. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. ***Rebuild.*** Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero, those age measurements (hours/miles, etc.) considered in classifying Army equipments/components.

B-4. Standard Groups

The standard groupings shown below are used, as applicable, throughout this MAC. Maintenance manuals and RPSTLs will reflect these standard groupings as individual chapters with sections in each chapter relative to the individual complete systems, subsystems, modules, components, assemblies, or specific parts noted.

B-5. Symbols

The letters "AVUM, AVIM and Depot" as placed on the Maintenance Allocation Chart, indicate the level of Maintenance responsible for performing the particular maintenance function based upon assigned skills, tools and test equipment and time required to accomplish maintenance.

GROUP NUMBER	DESCRIPTION
0400	ENGINE SYSTEM
0401	ENGINE GENERAL Servicing, handling, inspection requirements, lubrication charts, overhaul and retirement schedules. External lines and hoses. (As applicable).
0402	COMPRESSOR SECTION Rotor, blades, vanes, impeller, stators, inlet guide vanes, main frame, particle separator, bleed valve, bearings, seals, external lines and hoses.
0403	COMBUSTION SECTION Liners, nozzles, stators, rotor seals, couplings, blades.
0404	POWER-TURBINE Nozzles, rotors, blades, exit guide vanes, exhaust frame, drive shaft, bearings, seals, external lines and hoses.
0405	ACCESSORY GEAR BOX Input/and output gears, seals, chips detector, housings, drive shaft, bearings, seals.
0406	FUEL SYSTEM Fuel Control, fuel boost pump, governor, fuel filter assembly, sequence valve. Fuel manifold, fuel nozzle, external lines and hoses.
0407	ELECTRICAL SYSTEM Electrical control units, exciters, thermocouples, ignition harness, electrical cables, history recorders, torque overspeed sensor, NP sensor, alternate stator, blowers.
0408	OIL SYSTEM Tanks, oil, filter, oil cooler, lube and scavenge pumps, oil filter bypass sensor, external lines and hoses.
04100	MISCELLANEOUS EQUIPMENT

B-6. Work Times.

The symbol —.— identifies the lowest level of Maintenance authorised to perform a maintenance function and indicates that work time figures are being developed and will be entered at a later date. When developed, this time will appear: for example as, 0.1 and also indicates the lowest level of authorised maintenance.

B-7. Tools and Test Equipment (Section III)

Special tools, test, and support equipment required to do maintenance functions are listed with a reference number to permit cross-referencing to column 5 in the MAC. In addition, the maintenance category authorized to use the device is listed along with the item National Stock Number and, if applicable, the number to aid in identifying the tool/device.

B-8. Remarks (Section IV)

Column 6 of the MAC contains alphabetic reference codes which are explained in Section IV of this appendix.

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS **ENGINE AIRCRAFT TURBOSHAFT**
MODEL T63-A-720

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		

NOTE

The AVUM Maintenance functions identified herein are restriced to Company size units. These units are authorized SC 4920-99-CL-A92 (AVUM No. 2) Tool Set and have 10 or more Aircraft assigned. Refer to paragraph 5-16(1)(a) and (b).

0400	ENGINE SYSTEM						
0401	TURBINE ENGINE	INSPECT	-.-			1	
		TEST	-.-			1,6,11	A
				-.-		1,6,11 16	B
		SERVICE	-.-			1,5	C
		INSTALL	-.-			1,2,14	D
		REPLACE	-.-			1,2,14, 17	D
		REPAIR	-.-			1,2	
		OVERHAUL			-.-		
0402	COMPRESSOR SECTION						
040201	COMPRESSOR ASSEMBLY	INSPECT	-.-			1	
		SERVICE	-.-			1,5	C
		INSTALL			-.-		
		REPLACE			-.-		
		REPAIR	-.-			1	
040202	INLET GUIDE VANES	INSPECT	-.-			1	
040203	COMPRESSOR CASE HALVES	INSPECT	-.-			1	
		SERVICE	-.-			1,5	C

Section II. MAINTENANCE ALLOCATION CHART (CONT.)

NOMENCLATURE OF END ITEMS **ENGINE AIRCRAFT TURBOSHAFT MODEL T63-A-720**

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY AVUM	AVIM	DEPOT	(5) TOOLS AND EQUIPMENT	(6) REMARKS
		INSTALL	-·-			1,2,10	
		REPLACE	-·-			1,2,10	
		REPAIR	-·-			1	E
040204	ROTOR ASSEMBLY	INSPECT	-·-			1	
		SERVICE	-·-			1,5	C
		INSTALL			-·-		
		REPLACE			-·-		
		REPAIR	-·-			1	E
040205	ANTI-ICE VALVE	INSPECT	-·-			1	
		TEST	-·-			1,3	
		INSTALL	-·-			1,2	
		REPLACE	-·-			1,2	
		REPAIR	-·-			1,2	
040206	DIFFUSER SCROLL	INSPECT	-·-			1	
		INSTALL			-·-		
		REPLACE			-·-		
		REPAIR	-·-			1	
040207	DIFFUSER VENT ORIFICE	INSPECT	-·-			1	
		INSTALL	-·-			1,2	
		REPLACE	-·-			1,2	
040208	COMPRESSOR BLEED VALVE	INSPECT	-·-			1	
		TEST	-·-			1	
		SERVICE	-·-			1	

Section II. MAINTENANCE ALLOCATION CHART (CONT.)

NOMENCLATURE OF END ITEMS **ENGINE AIRCRAFT TURBOSHAFT MODEL T63-A-720**

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
		INSTALL	-·-			1,2	
		REPLACE	-·-			1,2	
040209	OIL PRESSURE REDUCER	INSPECT	-·-			1	
		INSTALL	-·-			1,2	
		REPLACE	-·-			1,2	
0403	COMBUSTION SECTION						
040301	OUTER CASE	INSPECT	-·-			1	
		INSTALL	-·-			1	
		REPLACE	-·-			1,2	
		REPAIR		-·-		1,2 4	F
040302	COMBUSTION LINER	INSPECT	-·-			1	
		INSTALL	-·-			1,2	
		REPLACE	-·-			1,2	
		REPAIR		-·-		1,3,4,9	F
040303	DISCHARGE AIR TUBES	INSPECT	-·-			1	
		INSTALL	-·-			1,2,12, 13	
		REPLACE	-·-			1,2,12, 13	
		REPAIR		-·-		1,4	F
0404	TURBINE SECTION						
040401	TURBINE ASSEMBLY	INSPECT	-·-			1	
		INSTALL			-·-		
		REPLACE			-·-		
		REPAIR			-·-		

Section II. MAINTENANCE ALLOCATION CHART (CONT.)

NOMENCLATURE OF END ITEMS **ENGINE AIRCRAFT TURBOSHAFT MODEL T63-A-720**

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
040402	FIRST STAGE NOZZLE	INSPECT	-·-			1	
040403	FIRST STAGE NOZZLE SHIELD	INSPECT	-·-			1	
040404	FIRST STAGE TURBINE BLADES	INSPECT	-·-			1	
040405	BURNER DRAIN VALVE	INSPECT	-·-			1	
		TEST	-·-			1,3	
		SERVICE	-·-			1	
		INSTALL	-·-			1,2	
		REPLACE	-·-			1,2	
0405	ACCESSORY GEARBOX						
040501	EXTERNAL SEALS	INSPECT	-·-			1	
		INSTALL		-·-		1,15	
		REPLACE		-·-		1,15	
040502	EXTERNAL STUDS	INSPECT	-·-			1	
		INSTALL		-·-		1,2,3,8	
		REPLACE		-·-		1,2,3,8	
040503	MAGNETIC CHIP DETECTOR	INSPECT	-·-			1	
		TEST	-·-			1	
		SERVICE	-·-			1	
		INSTALL	-·-			1,2	
		REPLACE	-·-			1,2	

Section II. MAINTENANCE ALLOCATION CHART (CONT.)

NOMENCLATURE OF END ITEMS

ENGINE AIRCRAFT TURBOSHAFT
MODEL T63-A-720

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY AVUM	AVIM	DEPOT	(5) TOOLS AND EQUIPMENT	(6) REMARKS
0406	FUEL SYSTEM						
040601	FUEL CONTROL	INSPECT	-·-			1	
		TEST	-·-			1,18	
		SERVICE	-·-			1	
		ADJUST	-·-			1,2,19, 20	
		INSTALL	-·-			1,2	
		REPLACE	-·-			1,2	
		REPAIR	-·-			1,2	
		OVERHAUL			-·-		
040602	FUEL CONTROL FUEL FILTER	INSPECT	-·-			1	
		SERVICE	-·-			1	
		INSTALL	-·-			1,2	
		REPLACE	-·-			1,2	
040603	GOVERNOR	INSPECT	-·-			1	
		TEST	-·-			1,3	
		INSTALL	-·-			1,2	
		REPLACE	-·-			1,2	
040604	FUEL PUMP	INSPECT	-·-			1	
		INSTALL	-·-			1,2	
		REPLACE	-·-			1,2	
		REPAIR	-·-			1,2	
		OVERHAUL			-·-		

Section II. MAINTENANCE ALLOCATION CHART (CONT.)

NOMENCLATURE OF END ITEMS **ENGINE AIRCRAFT TURBOSHAFT MODEL T63-A-720**

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
040605	FUEL FILTER	INSPECT	-·-			1	
		SERVICE	-·-			1	
		INSTALL	-·-			1,2	
		REPLACE	-·-			1,2	
040606	FUEL NOZZLE	INSPECT	-·-			1	
		SERVICE	-·-			1,2	
		INSTALL	-·-			1,2	
		REPLACE	-·-			1,2	
040607	DOUBLE CHECK VALVE	INSPECT	-·-			1	
		INSTALL	-·-			1,2	
		REPLACE	-·-			1,2	
040608	ACCUMULATORS	INSPECT	-·-			1	
		TEST	-·-			1,2	
		SERVICE	-·-			1	
		INSTALL	-·-			1,2	
		REPLACE	-·-			1,2	
040609	FUEL CHECK VALVE	INSPECT	-·-			1	
		INSTALL	-·-			1,2	
		REPLACE	-·-			1,2	
040610	PC AIR FILTER ASSEMBLY	INSPECT	-·-			1	
		SERVICE	-·-			1	

Section II. MAINTENANCE ALLOCATION CHART (CONT.)

NOMENCLATURE OF END ITEMS

ENGINE AIRCRAFT TURBOSHAFT
MODEL T63-A-720

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY AVUM	 AVIM	 DEPOT	(5) TOOLS AND EQUIPMENT	(6) REMARKS
		INSTALL	–·–			1,2	
		REPLACE	–·–			1,2	
		REPAIR	–·–			1	
040611	EXTERNAL LINES AND HOSES	INSPECT	–·–			1	
		INSTALL	–·–			1,2	
		REPLACE	–·–			1,2	
0407	ELECTRICAL SYSTEM						
040701	EXCITER ASSEMBLY	INSPECT	–·–			1	
		TEST	–·–			1	
		INSTALL	–·–			1,2	
		REPLACE	–·–			1,2	
040702	SPARK IGNITER	INSPECT	–·–			1	
		TEST	–·–			1	
		SERVICE	–·–			1	
		INSTALL	–·–			1,2	
		REPLACE	–·–			1,2	
040703	SPARK IGNITER LEAD	INSPECT	–·–			1	
		INSTALL	–·–			1,2	
		REPLACE	–·–			1,2	
040704	THERMOCOUPLE ASSEMBLY	INSPECT	–·–			1	
		TEST	–·–			1,7	

Section II. MAINTENANCE ALLOCATION CHART (Cont.)

NOMENCLATURE OF END ITEMS

ENGINE ARICRAFT TURBOSHAFT
MODEL T63-A-720

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
040705	THERMOCOUPLE TERMINAL ASSEMBLY	INSPECT	—·—			1	
		INSTALL	—·—			1,2	
		REPLACE	—·—			1,2	
0408	OIL SYSTEM						
040801	OIL FILTER HOUSING	INSPECT	—·—			1	
		INSTALL	—·—			1,2	
		REPLACE	—·—			1,2	
040802	OIL FILTER	INSPECT	—·—			1	
		SERVICE	—·—			1	
		INSTALL	—·—			1,2	
		REPLACE	—·—			1,2	
		REPAIR	—·—			1,2	
040803	OIL PRESSURE REGULATOR	INSPECT	—·—			1	
		TEST	—·—			1	
		ADJUST	—·—			1	
		INSTALL	—·—			1,2	
		REPLACE	—·—			1,2	
040804	INTERNAL OIL CHECK VALVE	INSPECT	—·—			1	
		SERVICE	—·—			1	
		INSTALL	—·—			1,2	
		REPLACE	—·—			1,2	
040805	EXTERNAL OIL CHECK VALVE	INSPECT	—·—			1	
		SERVICE	—·—			1	
		INSTALL	—·—			1,2	

Section II. MAINTENANCE ALLOCATION CHART (CONT.)

NOMENCLATURE OF END ITEMS

ENGINE AIRCRAFT TURBOSHAFT
MODEL T63-A-720

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY			(5) TOOLS AND EQUIPMENT	(6) REMARKS
			AVUM	AVIM	DEPOT		
		REPLACE	–.–			1,2	
040606	EXTERNAL LINES AND FITTINGS	INSPECT	–.–			1	
		INSTALL	–.–			1	
		REPLACE	–.–			1	
04100	MISCELLANEOUS EQUIPMENT						
041001	FAT THERMOMETER	INSTALL	–.–				
		TEST	–.–			1,2	
		REPLACE	–.–				
041002	TOT GAGE	INSTALL	–.–				
		TEST	–.–			1,2	
		REPLACE	–.–			21	
041003	TACHOMETER	INSTALL	–.–			1,2	
		TEST	–.–			21	
		REPLACE	–.–				

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

NOMENCLATURE OF END ITEMS ENGINE AIRCRAFT TURBOSHAFT MODEL T63-A-720

TOOL OR TEST EQUIPMENT REFERENCE CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	AVUM	TOOL KIT, ENGINE REPAIRMANS	5180003234944	SC518099CLA07
2	AVUM	TOOL SET, AVUM SET NO. 2	4920005670476	SC92099CLA92
3	AVIM	SHOP SET, AVIM TURBINE ENGINE	4920002243684	SC492092CLA91 ENTAM
4	AVIM	SHOP SET, AVIM WELDING, AVIM WELDING	4920001635093	SC492099CLAWEAM
5	AVUM	KIT, PROTECTOR COMPRESSOR CLEANING	4920010301011	6886204
6	AVUM	KIT, VIBRATION SIGNAL SOURCE	4920008790331	171170-0104
7	AVUM	TOOL KIT, ELECTRICAL REPAIRMANS	5180003234915	SC518099CLA06
8	AVIM	SHOP SET, AVIM MACHINE SHOP	4920004059279	SC492099CLA91 MAAM
9	AVIM	SHOP SET, AVIM SHEET METAL	4920001665505	SC492099CLA91 SMAM
10	AVIM	ADAPTER, ENGINE TURNING	4920009233188	6799790
11	AVUM	BRACKET, MOUNTING COMPRESSOR VIBRATION PICKUP	4920000301022	6872539
12	AVUM	CLAMP, LOOP	5340009450244	6799952
13	AVUM	CLAMP, LOOP	5340009450242	6799953
14	AVUM	LIFT, ENGINE ASSEMBLY	5120009247722	6796963
15	AVIM	PULLER, KIT MECHANICAL	5120009450186	6796941
16	AVIM	STAND TEST, ENGINE MODULAR	4920001679178	LTCT10465-02
17	AVUM	STAND, ENGINE TURNOVER	4920009245726	6795579
18	AVUM	STOP WATCH	6645002504680	10531878
19	AVUM	WRENCH, BRISTOL	5120002242482	S111
20	AVUM	WRENCH, GROUND IDLE	5120007637565	6798292
21	AVU M	JET-CAL ANALYSER	4920006735514	BH-112-JA-36

Section IV. REMARKS

T63-A-720 TURBOSHAFT

REFERENCE CODE	REMARKS/NOTES
A	Functional Test at AVUM - Engine in Airframe
B	Functional Test at AVIM - Engine in METS
C	Water/Solvent Solution Wash
D	Reference TM 55-1520-228-23
E	Blend Repair Only
F	Weld Repair

ALPHABETICAL INDEX

Subject *Page*

A

Acceleration bleed air system 1-10
Accident engine preservation 3-5
Accumulator 5-15
Adjustment, oil pressure regulator 5-18
Air bleed extraction 1-12
Air bleed system (See acceleration bleed air system.)
Anti-icing air valve 5-22
Anti-icing system:
  Description 1-10
  Servicing 5-22
Anti-icing valve poppet seat replacement 5-22

B

Blades, compressor, inspection 7-4
Blades, compressor rotor cleaning 7-3
Blades, turbine first-stage, inspection 7-14
Bleed air extraction 1-12
Bleed air system (See acceleration bleed air system.)

Bleed valve, compressor 5-22
Bleeding the fuel system 5-3
Burner drain valve 5-28

C

Cannibalized engine preservation 3-5
Case, outer combustion (see outer combustion case.)
Check valve, double check 5-14
Check valve, fuel 1-10
Check valve, oil, external 5-20
Check valve, oil, internal 5-20
Chip detectors 5-17
Cleaning:
  Accumulator 5-15
  Burner drain valve 5-28
  Compressor case half 7-3
  Compressor—to remove salt water contamination 7-2
  Compressor—to restore lost performance 7-1
  Compressor rotor blades 7-3
  Engine exterior surfaces 7-1
  External oil check valve 5-20
  Fuel nozzle 5-14
  General procedures 7-1
  Magnetic chip detectors 5-17
  Oil filter 5-18
  Oil pressure reducer 5-21
  Pc air filter 5-4
  Spark igniter 5-27
Cleaning procedures, general 7-1
Combustion case (See outer combustion case.)
Combustion liner:
  Inspection 7-10
  Repair 7-21
Combustion section:
  Description 1-3
  Installation 9-1
  Removal 3-14
Compressor:
  Case half cleaning 7-3
  Case half installation 8-1
  Case half removal 6-1
  Case painting 7-17
  Case repair 7-16
  Cleaning—to remove salt water contamination 7-2
  Cleaning—to restore lost performance 7-1
  Discharge air tube seal rings inspection 7-10
  Discharge air tubes inspection 7-10
  Discharge air tubes weld repair 7-19
  Description 1-3
  Erosion inspection 7-6
  Foreign object damage inspection 12-3
  Front support inspection 7-6
  Inlet blockage inspection 12-3
  Plastic coating inspection 7-5
  Rotor and blades inspection 7-4
  Rotor and blades repair 7-15
  Rotor blades cleaning 7-3
  Snow and ice ingestion inspection 12-3
  Stator vane inspection 7-5
  Stator vanes repair 7-16
  Vibration inspection 12-3
Compressor bleed valve 5-22
Compressor bleed valve, cleaning 7-3
Compressor case half removal 6-1
Consumable materials 2-4
Container, engine shipping (See shipping container.)
Control, fuel (See gas producer fuel control.)
Control system, fuel and 1-4

Subject *Page*

D

Damaged engine preservation 3-5
Deceleration check 5-11
Depreservation, engine 3-2
Description:
  Acceleration bleed air system 1-10
  Air bleed extraction 1-12
  Anti-icing system 1-10
  Combustion section 1-3
  Compressor 1-3
  Double check valve 1-10
  Engine general 1-2
  Engine operation 1-4
  Fuel and control system 1-4
  Fuel check valve 1-10
  Fuel nozzle 1-10
  Fuel pump and filter assembly 1-9
  Gas producer fuel control 1-6
  Ignition system 1-10
  Lubrication system 1-10
  Pc air filter 1-10
  Power and accessory gearbox 1-4
  Power turbine governor 1-6
  Temperature measurement system 1-10
  Turbine 1-4
Destruction of Army material to prevent enemy use ... 1-1
Diffuser scroll inspection 7-6
Diffuser scroll repair 7-18
Diffuser vent orifice selection 10-7
Dimensional limits 11-4
Dimensions, engine 1-14
Dimensions, shipping container:
  Engine 3-10
  Fuel pump and filter assembly 3-10
  Gas producer fuel control 3-10
  Power turbine governor 3-10
Dismantling engine into major functional assemblies ... 3-14
Double check valve 5-14
Double check valve description 1-10
Drive gear replacement
  Gas producer fuel control 5-8
  Power turbine governor 5-13

E

Engine depreservation (See depreservation.)
Engine dismantling into major functional assemblies ... 3-14
Engine exterior surfaces cleaning 7-1
Engine general description 1-2
Engine installation in turnover stand 3-13

Subject *Page*

Engine installation into shipping and storage container ... 3-6
Engine operation, description of 4-1
Engine preservation 3-5
Engine specifications 1-14
Engine testing:
  Diffuser vent orifice selection 10-7
  Drainage requirements 10-7
  Electrical supply requirements 10-7
  Fuel requirements 10-7
  Functional test schedule 10-7
  Instrumentation requirements 10-1
  Lubricating oil requirements 10-7
  Motoring procedure 10-1
  Operating parameters 10-4
  Operating procedures 10-1
  Preparation for test 10-1
  Preservation requirements 10-7
  Test requirements 10-5
Errors, reporting of 1-1
Exciter, ignition 5-25
Exhaust collector support inspection 7-7
External oil check valve 5-20

F

Failed engine preservation 3-5
Filter assembly, fuel (See fuel pump and filter assembly.)
Filter, oil 5-18
Filter, Pc air 5-4
Fittings, universal 5-2
Foreign object damage inspection 12-3
Forms and records, maintenance 1-1
Fuel and control system:
  Bleeding the system 5-3
  Description 1-4
  Pneumatic leak check 5-3
Fuel check valve 1-10
Fuel control (See gas producer fuel control.)
Fuel filter:
  Engine 5-4
  Gas producer fuel control 5-12
Fuel nozzle:
  Cleaning 5-14
  Description 1-10
  Inspection 5-15
  Installation 5-15
  Removal 5-14
Fuel pump and filter assembly:
  Description 1-9
  Filter replacement 5-4

Subject — *Page*

  - Installation 5-4
  - Preparation for storage and shipment 3-11
  - Removal 5-4
  - Testing 5-4
- Fuel system bleeding 5-3
- Fuel system tubes 5-15
- Functional test schedule 10-7

G

- Gas producer fuel control:
  - Deceleration check 5-11
  - Description 1-6
  - Drive gear replacement 5-8
  - Idle speed check 5-10
  - Installation 5-9
  - Max fuel flow stop adjustment 5-11
  - Maximum speed stop 5-10
  - Preparation for storage and shipment 3-12
  - Removal 5-8
  - Replacing fuel filter 5-12
  - Rigging check 5-9
  - Start derichment adjustment 5-11
- Gearbox (See power and accessory gearbox.)
- General cleaning procedures 7-1
- General description, engine 1-2
- General practices and precautions 5-1
- Governor (See power turbine governor.)

H

- Hard landing inspection 12-4
- Hardware 5-1
- Health indicator test 4-13
- Housing, oil filter 5-20

I

- Idle speed check 5-10
- Igniter, spark 5-27
- Ignition exciter 5-25
- Ignition system:
  - Check 5-25
  - Description 1-10
  - Servicing 5-25
- Inspection:
  - Combustion liner 7-10
  - Compressor discharge air tube seal rings 7-10
  - Compressor discharge air tubes 7-10
  - Compressor erosion 7-6
  - Compressor front support 7-6
  - Compressor inlet blockage 12-3

Subject — *Page*

  - Compressor plastic coating 7-5
  - Compressor rotor and blades 7-4
  - Compressor stator vane 7-5
  - Compressor vibration 12-3
  - Diffuser scroll 7-6
  - Double check valve 5-14
  - Engine dropped during handling 3-2
  - Exhaust collector support 7-7
  - Foreign object damage 12-3
  - Fuel nozzle 5-15
  - Gearbox 7-6
  - Hard landing 12-4
  - Ignition exciter 5-25
  - Magnetic chip detectors 5-17
  - Oil pressure regulator 5-18
  - Outer combustion case 7-7
  - Overtemperature during power transients 12-1
  - Overtemperature during start 12-1
  - Pc air filter 5-4
  - Power and accessory gearbox inspection 7-6
  - Shipping container 3-1
  - Snow and ice ingestion 12-3
  - Spark igniter 5-27
  - Spark igniter lead 5-27
  - Sudden stoppage 12-4
  - Thermocouple assembly 7-7
  - Turbine first-stage blades 7-14
  - Turbine first-stage nozzle and shield 7-14
  - Turbine overtemperature 12-1
- Installation:
  - Accumulator 5-15
  - Anti-icing air valve 5-22
  - Burner drain valve 5-28
  - Combustion section 9-1
  - Compressor bleed valve 5-25
  - Compressor case half 8-1
  - Double check valve 5-14
  - Engine into shipping container 3-6
  - External oil check valve 5-20
  - Fuel nozzle 5-15
  - Fuel pump and filter assembly 5-4
  - Gas producer fuel control 5-9
  - Ignition exciter 5-27
  - Internal oil check valve 5-20
  - Magnetic chip detectors 5-17
  - Oil filter 5-18
  - Oil filter housing 5-20
  - Oil pressure reducer 5-21
  - Oil pressure regulator 5-18
  - Pc air filter 5-4
  - Power turbine governor 5-13
  - Rigid tube 5-3
  - Spark igniter 5-27

Subject *Page*

  - Spark igniter lead 5-28
  - Thermocouple terminal assembly 5-28
- Installing engine in turnover stand 3-13
- Internal oil check valve 5-20

L

- Lead, spark igniter 5-27
- Leading particulars 1-12
- Leak check, fuel system pneumatic 5-3
- Liner, combustion (See combustion liner.)
- Lubrication system:
  - Description 1-10
  - Servicing 5-16

M

- Magnetic chip detectors 5-17
- Maintenance allocation chart:
  - Additional information B-2
  - Definitions B-1
  - Deviations B-1
  - General B-1
- Maintenance forms and records 1-1
- Measurement system, temperature (See temperature measurement system.)
- Mixing of engine oils 5-17
- Motoring procedure, engine 10-1

N

- Nozzle, fuel (See fuel nozzle)
- Nozzle shield, turbine first-stage, inspection 7-14
- Nozzle, turbine first-stage, inspection 7-14

O

- Oil change procedure 5-16
- Oil changeover procedure 5-16
- Oil filter 5-18
- Oil filter housing 5-20
- Oil pressure reducer 5-21
- Oil pressure regulator 5-18
- Oil system (See lubrication system.)
- Oil tubing and fittings 5-17
- Oils, mixing of 5-17
- Operating parameters, engine 10-4
- Operation, description of 1-4
- Outer combustion case:
  - Inspection 7-7
  - Weld repair 7-19
- Overhaul interval 13-1
- Overtemperature during power transients 12-1
- Overtemperature during start 12-1
- Overtemperature inspection, turbine 12-1

Subject *Page*

P

- Painting:
  - Compressor case 7-17
  - Gearbox housing and cover 7-19
- Plastic coating inspection 7-5
- Pneumatic leak check, fuel system 5-3
- Power and accessory gearbox:
  - Description 1-4
  - External seals replacement 7-18
  - External studs replacement 7-18
  - Painting 7-19
  - Inspection 7-6
- Power turbine governor:
  - Description 1-6
  - Drive gear replacement 5-13
  - Installation 5-13
  - Preparation for storage and shipment 3-12
  - Removal 5-13
- Poppet seat replacement, anti-icing valve 5-22
- Preparation for storage and shipment:
  - Engine 3-5
  - Fuel pump and filter assembly 3-11
  - Gas producer fuel control 3-12
  - Power turbine governor 3-12
- Preservation:
  - Accident engine 3-5
  - Damaged, cannibalized, or failed engine 3-5
  - Engine 3-5
  - Forms, records, tags, and stenciling 3-5
  - Fuel control 3-12
  - Fuel pump 3-11
  - Governor 3-12
  - Preservation maintenance 3-1
- Pump assembly, fuel (See fuel pump and filter assembly.)

S

- Seal rings (See compressor discharge air tube seal rings.)
- Scroll (See diffusor scroll.)
- Shipping container, accessory:
  - Container stenciling 3-5
  - Dimensions and weight 3-10
  - Preparation of 3-11
- Shipping container, engine:
  - Dimensions and weight 3-10
  - Inspection 3-1
  - Installation of engine 3-6
  - Internal pressure and humidity check 3-12
  - Maintenance during storage 3-8
  - Preparation of 3-7
  - Pressurization 3-7

Subject *Page*

  Removal of engine 3-1
  Stenciling 3-5
  Tamper-proof security 3-8
Snow and ice ingestion inspection 12-3
Spark igniter 5-27
Spark igniter lead 5-27
Special tools and test equipment 2-1
Specifications, engine 1-14
Start derichment adjustment 5-11
Storage and shipment:
  Engine 3-1
  Fuel pump and filter assembly 3-11
  Gas producer fuel control 3-12
  Power turbine governor 3-12
Sudden stoppage inspection 12-4
Systems description:
  Acceleration bleed air 1-10
  Anti-icing 1-10
  Fuel and control 1-4
  Ignition 1-10
  Lubrication 1-10
  Temperature measurement 1-10

T

Temperature measurement system 1-10
Terminal assembly, thermocouple 5-28
Test equipment 2-1
Test, health indicator 4-13
Testing:
  Accumulator 5-15
  Anti-icing air valve 5-22
  Burner drain valve 5-28
  Compressor bleed valve 5-22
  Engine (See engine testing.)
  Fuel pump and filter assembly 5-4
  Magnetic chip detectors 5-17
  Oil filter 5-18
  Oil pressure regulator 5-18
  Spark igniter 5-27
Thermocouple assembly inspection 7-7
Thermocouple terminal assembly 5-28
Tools, special 2-1
Torque values 11-1
Troubleshooting 4-1
Tubing and fittings, oil 5-17
Tubing, fuel 5-15
Turbine:
  Description 1-4
  First-stage blades inspection 7-14
  First-stage nozzle and shield inspection 7-14
  Overtemperature inspection 12-1

Subject *Page*

U

Universal fittings 5-2
Use of oils 5-16

V

Valve, anti-icing air 5-22
Valve, burner drain 5-28
Valve, check, external oil 5-20
Valve, check, internal oil 5-20
Valve, compressor bleed 5-22
Valve, double check 5-14
Valve, fuel check 1-10
Vanes, compressor, inspection 7-5

W

Weight, engine 1-14
Weight, shipping container:
  Engine 3-10
  Fuel pump and filter assembly 3-10
  Gas producer fuel control 3-10
  Power turbine governor 3-10

R

Reducer, oil pressure 5-21
References A-1
Regulator, oil pressure 5-18
Removal:
  Accessory from shipping container 3-8
  Accumulator 5-15
  Anti-icing air valve 5-22
  Burner drain valve 5-28
  Combustion section 3-14
  Compressor bleed valve 5-22
  Compressor case half 6-1
  Double check valve 5-14
  Engine from shipping container 3-1
  External oil check valve 5-20
  Fuel nozzle 5-14
  Fuel pump and filter assembly 5-4
  Gas producer fuel control 5-8
  Ignition exciter 5-25
  Internal oil check valve 5-20
  Magnetic chip detectors 5-17
  Oil filter 5-18
  Oil filter housing 5-20
  Oil pressure reducer 5-21
  Oil pressure regulator 5-18
  Pc air filter 5-4
  Power turbine governor 5-13
  Spark igniter 5-27

Subject *Page*

  Spark igniter lead 5-27
  Thermocouple terminal assembly 5-28
Removing combustion section 3-14
Repair:
  Combustion liner 7-21
  Compressor case vanes 7-16
  Compressor discharge air tubes 7-19
  Compressor rotor and blades 7-15
  Diffuser scroll 7-18
  Outer combustion case 7-19

Subject *Page*

Replacement:
  Anti-icing valve poppet seat 5-22
  Fuel filter 5-4
  Gearbox external seals 7-18
  Gearbox external studs 7-18
Reporting of errors 1-1
Retirement life interval 13-1
Rigging check, gas producer fuel control 5-9
Rigid tube installation 5-3
Rotor, compressor, inspection 7-4

✩U.S. GOVERNMENT PRINTING OFFICE: 1989 242-451/05020

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

THEN. . .JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

Commander
Aviation Company
4th Infantry Division
Fort Carson, CO 80913

DATE

PUBLICATION NUMBER	DATE	TITLE
TM 55-1520-210-PMS	22 Sep 75	Preventive Maintenance Services

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.
13			

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

Item No. 5.7 Recommend that X's be added to Sequence Number 5.7 under D (daily) and I (intermediate). The teardown analysis result from Corpus Christi Army Depot for engine number LE 21632 from aircraft 69-15324 revealed packed hard dirt had formed over the selfpurging port. This prevented sand and dust from being ejected overboard and eventually recirculated until ingested into the engine. This caused an excessive amount of erosion on internal components preventing the engine from producing maximum power. This inability contributed to a major accident involving fatalities. Increasing the inspection frequency would preclude a reoccurance of this malfunction.

SAMPLE

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE:

TEAR ALONG DOTTED LINE

DA FORM 1 AUG 74 2028-2 (TEST)

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

best copy available

FILL IN YOUR
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD-314

Commander
USATSARCOM
ATTN: DRSTS-MTPS
4300 Goodfellow Blvd.
St. Louis, MO 63120

TEAR ALONG DOTTED LINE

FOLD BACK

REVERSE OF DA FORM 2028-2 (TEST)

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

THEN. . .JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

DATE

PUBLICATION NUMBER	DATE	TITLE
TM 55-2840-241-23	2 Nov 77	AVUM and AVIM Maintenance Manual Engine, Aircraft, Gas Turbine

BE EXACT. . .PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO.	PARAGRAPH	FIGURE NO.	TABLE NO.	

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE:

TEAR ALONG DOTTED LINE

DA FORM 1 AUG 74 2028-2 *(TEST)*

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

FILL IN YOUR
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

____

____

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD-314

Commander
USATSARCOM
ATTN: DRSTS-MTPS
4300 Goodfellow Blvd.
St. Louis, MO 63120

TEAR ALONG DOTTED LINE

FOLD BACK

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

THEN. . .JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

DATE

PUBLICATION NUMBER TM 55-2840-241-23	DATE 2 Nov 77	TITLE AVUM and AVIM Maintenance Manual Engine, Aircraft, Gas Turbine

BE EXACT. . .PIN-POINT WHERE IT IS				IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE:

TEAR ALONG DOTTED LINE

DA FORM 1 AUG 74 2028-2 *(TEST)*

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

FILL IN YOUR
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD-314

Commander
USATSARCOM
ATTN: DRSTS-MTPS
4300 Goodfellow Blvd.
St. Louis, MO 63120

TEAR ALONG DOTTED LINE

FOLD BACK

REVERSE OF DA FORM 2028-2 (TEST)

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

THEN. . . JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

SOMETHING WRONG WITH THIS MANUAL?

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

DATE

PUBLICATION NUMBER	DATE	TITLE
TM 55-2840-241-23	2 Nov 77	AVUM and AVIM Maintenance Manual Engine, Aircraft, Gas Turbine

BE EXACT. . . PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE:

TEAR ALONG DOTTED LINE

DA FORM 1 AUG 74 2028-2 (TEST)

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

FILL IN YOUR
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD-314

Commander
USATSARCOM
ATTN: DRSTS-MTPS
4300 Goodfellow Blvd.
St. Louis, MO 63120

TEAR ALONG DOTTED LINE

FOLD BACK

REVERSE OF DA FORM 2028-2 (TEST)

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL MANUALS

SOMETHING WRONG WITH THIS MANUAL?

THEN. . .JOT DOWN THE DOPE ABOUT IT ON THIS FORM, TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

FROM: (YOUR UNIT'S COMPLETE ADDRESS)

DATE

PUBLICATION NUMBER TM 55-2840-241-23	DATE 2 Nov 77	TITLE AVUM and AVIM Maintenance Manual Engine, Aircraft, Gas Turbine

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE:

DA FORM 1 AUG 74 2028-2 (TEST)

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR MANUAL "FIND," MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

TEAR ALONG DOTTED LINE

FILL IN YOUR
UNIT'S ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

____

____

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE, $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD-314

Commander
USATSARCOM
ATTN: DRSTS-MTPS
4300 Goodfellow Blvd.
St. Louis, MO 63120

TEAR ALONG DOTTED LINE

FOLD BACK

REVERSE OF DA FORM 2028-2 (TEST)

PIN: 033211-000